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An econometric study of the Cyprus economy

Stahis Solomon Panagides
Iowa State University

AN ECONOMETRIC STUDY OF THE CYPRUS ECONOMY

by

Stahis Solomon Panagides

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Signature was redacted for privacy.

Head of Major Department

Signature was redacted for privacy.

Dean of Graduate College

Iowa State University
Of Science and Technology
Ames, Iowa

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"Ἦν δέ καί παραπλησίους γεωργίας γεωργοῦντας τούς μέν ἀπολωλέναι φάσκοντας ὑπό γεωργίας καί ἀποροῦντας, τούς δέ ἀφθόνως καί καλῶς πάντα ἔχοντας, ὅσων δέονται, ἀπό τῆς γεωργίας;
Ναί μά Δί,....."*

"And that when men farm the same kind of land, some are poverty stricken and declare that they are ruined by agriculture, and others do well with the farm and have all they want in abundance?"

"Yes, of course; ..."

*Xenophon. Oeconomicus, with an English translation by E. C. Marchant. Harvard University Press, p. 384. 1923.

CHAPTER I. INTRODUCTION

A study of Cyprus is of great interest to the analyst. To the development economist, the island is of interest being faced with most problems typical of developing countries. It is a small economy characterized by a combination of export-consumption led development, intrinsically, until very recently, to Britain, the metropolis. To the economic historian, Cyprus provides an excellent example, showing how man throughout history used a small Mediterranean island for his livelihood and how this association of man and the island has changed through the centuries.

Presently, Cyprus is a major source of international tension; a place where man's inherited "myths" surpass the hard realities of his true interest and where the common tillage of land and the sweating side by side for four centuries, of Greeks and Turks alike, failed to unite the two peoples.

Some Historical and Demographic Characteristics

Cyprus is an island in the Eastern Mediterranean having been inhabited since neolithic times. Around the 10th century B. C., due to Greek colonization, the island was given an almost thorough Greek character. Due to its location, famous wines, copper mines and natural beauty, the island has been conquered by various powers throughout its history. The Ottoman Turks conquered Cyprus in 1570 and ruled the island to the year 1878 when, by agreement, it was passed over to Great Britain on lease. The British became masters of Cyprus in 1914 when Turkey sided with Germany against the Allies. In 1925 Cyprus was declared by Britain

a Crown Colony and it remained as such until 1960 when the Cyprus Republic was established (59, 61). A significant result of the Turkish occupation was the settlement on Cyprus of a Turkish minority among the predominantly Greek community.

Cyprus, the third largest island in the Mediterranean* presents interesting contrasts within her shores both in demography and morphology which give her the character of a much larger nation in microcosm. The island's main morphological characteristics are two mountain ranges, one of which culminates in Mount Olympus, 6,403 feet above sea level (see map Fig. 1). The lower altitudes of the mountain ranges and the plain that connects them provide the major share of agricultural land. Mediterranean agriculture led by citrus, grapes, cereals, other fruit and vegetables (where water is not scarce) typifies production.

Rainfall is a constant problem especially during the summer months. The subsequent econometric findings show rainfall to be a very significant explanatory variable of agricultural production. The rainfall index (assigning a higher weight for plain rainfall) gives an annual average of 18.2 inches for the period 1950-1963, but the mountain rainfall is much higher than that of the plains. Only 10 percent of privately owned land (3,200,000 donums) is perennially or mechanically irrigated**. The rainfall pattern is not always a blessing. Heavy winter rains after long dry summers continue to erode an already depleted topsoil. Though 18-20

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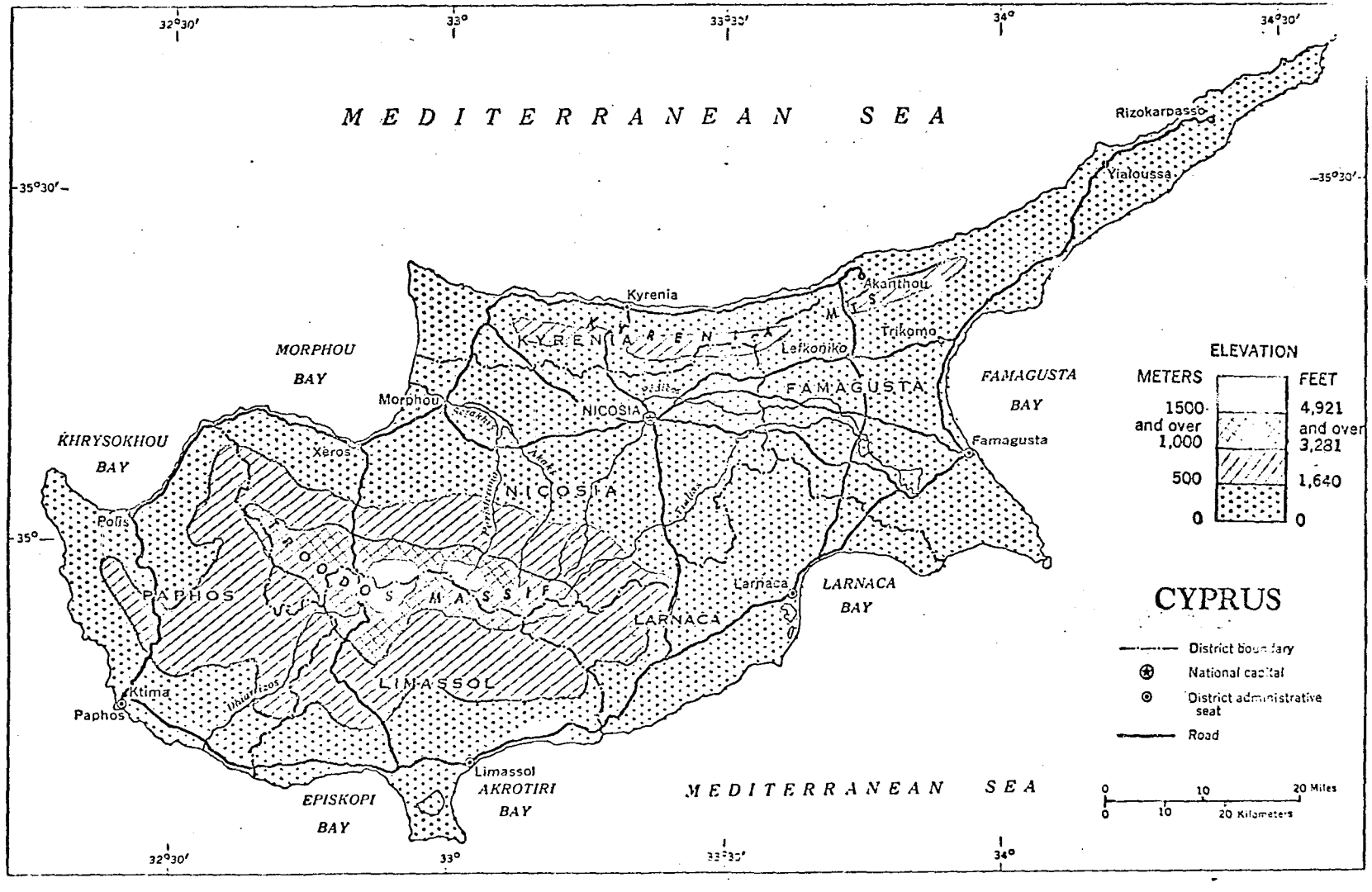
*Total area is 3,572 square miles.

**1 acre = 2.025 donums.

percent of the island is covered with national forests, the agricultural lowlands continue to erode at dangerous proportions.

In addition to agriculture, mining (copper) and tourism are other profitable activities for the island. The location of Cyprus renders it of strategic importance especially to Britain which maintains major military bases on the island. In the last fifteen years income from British military expenditure has been a most important source of wealth but not without considerable repercussions on the country's development.

What follows is not a comprehensive study of the Cyprus economy such as would be needed for the formulation of development plans. We concentrate, instead, on what economic theory the econometric results and experience of other countries show to be important economic variables in the future of Cyprus development. An alternative title of this work though tautological to the one given, could have been: An econometric study of a small country economy: Some overriding considerations.


32°30′
33°
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MEDITERRANEAN SEA
Rizokarpasso
Yialoussa
Kyrenia
Akanthou
Trikomo
Lefkoniko
KYRENIA
FAMAGUSTA
MORPHOU BAY
Morphou
NICOSIA
Famagusta
FAMAGUSTA BAY
KHRYSOKHOU BAY
Xeros
Polis
NICOSIA
TROODOS MASSIF
PAFHOS
LARNACA
Larnaca
LARNACA BAY
LIMASSOL
Ktima
Paphos
Limassol
AKROTIRI BAY
EPISKOPI BAY
ELEVATION
METERS
FEET
1500 and over
1,000
500
0
4,921 and over
3,281
1,640
0
CYPRUS
District boundary
National capital
District administrative seat
Road
0 10 20 Miles
0 10 20 Kilometers

FIG. 1. CYPRUS

CHAPTER II. THE ECONOMY DURING THE PERIOD 1950-1963 - AN OVERVIEW

This work is a first attempt to study the economy of Cyprus econometrically. The economy is investigated via a number of econometric models with concentration on:

1. Alternative projections of relevant economic variables and their policy implications,
2. The role of the import-export sector and the projected restraint to growth posed by the balance of payments deficit in a small, highly open economy,
3. Individual sectors and the implications from the estimated sectorial equations on future policy, especially of agriculture and manufacturing,
4. Policy multipliers and the effect of alternative "policy mixes" on GNP and the balance of payments,
5. Some economic aspects of the Greek-Turkish conflict in view of the overall objectives of economic policy,
6. A 45 equation model used in the maximization of national output with the use of linear programming at a projected period (1970).

The logic of the models presented follows the national income account concepts of measuring the performance of an economy. It is of the type:

1. $Y_{Su} = f_1 (Y_l, Y_n, Y_G)$ supply - (value added)
2. $Y_D = f_2 (C, X, G_C)$ demand - (expenditure)

3. $Y_{Su} = Y_D$ equilibrium condition

Where Yi, C, X, and G_C are endogenous or exogenous variables, with the necessary definitions incorporated in the above basic structure. The years 1959, 1960 (a turning point) and 1963 are in the sample period. The forecast for 1964 is a true forecast since that year was not included in the single stage least squares (SSLS) estimation of the stochastic equations, except for three equations which are discussed later. It is to be noted that 1964 was a most unusual year. Internal civil strife (Greek-Turkish conflict) had rather adverse repercussions on the economy. The models as judged by their forecasting performance do rather well when considering the many limitations in data and the absence of any previous econometric work of this kind on Cyprus.

An econometric model estimated by time series is in a sense a study of the past performance of the system. The implicit hope from the analyst's point of view, and especially that of the policy maker, is that the average mode of relations among economic variables observed over the past will be approximately the same in the future.

The historical character of econometric models prompts the review of past experience by the Cyprus economy. We need to review briefly the important characteristics of the economy over the period 1950-1963, the period used for the estimation of most relations in this study. The Cyprus economy during this period, as well as earlier, cannot be understood apart from her dependence on Britain. The island was not an autonomous unit but rather an extension of the British Isles. Britain found it convenient to locate her military bases on Cyprus and pay for them, while the

Cypriots could, in return, afford to buy the desired goods from the British metropolis. At the same time Britain remained the prime market for Cyprus exports so that Cyprus was in reality no more than an extension of Britain in the Eastern Mediterranean. The economic relation of Cyprus to Britain was not unlike that between Britain and some of her colonies described by John Stuart Mill in his Principles of Political Economy long ago.(77a) Mill wrote:

> "There is a class of trading and exporting communities on which a few words of explanation seem to be required. These are hardly to be looked upon as countries, carrying on an exchange of commodities with other countries, but more properly as outlying agricultural or manufacturing establishments belonging to a larger community..... If Manchester, instead of being where it is, were on a rock in the North Sea, it would still be but a town of England.....a place where England finds it convenient to carry on her cotton manufacture."

So it was with Cyprus. Table 1, exports by country of destination and imports by country of origin, shows the link with Britain through the merchandise trade. The dependence on Britain proved profitable but only while it lasted. The association with Britain remains still the cornerstone of Cyprus economic policy and will have to remain so for considerable time as it would become evident in the course of this study.

The period of 1950-1963 is marked by three important developments: (1) the decision by the British government to transform Cyprus into her major military base in the Near East, (2) the struggle for independence, and (3) the establishment of the Republic of Cyprus in the summer of 1960. Such a turmoiled period is hardly conducive to normal behavior on which the stability of economic relations rests. Yet it may be that significant economic constants are best discovered under abnormal conditions when the

Table 1. Imports and exports by currency area*

Areas	1962		1963		1964	
	Value £000	%	Value £000	%	Value £000	%
All Currency Areas	44,953	100.0	47,141	100.0	37,616	100.0
Sterling	17,412	38.7	18,616	39.5	14,070	37.4
United Kingdom	15,099	33.6	15.679	33.3	11,392	30.3
Rest of Sterling Area	2,313	5.1	2.937	6.2	2,678	7.1
Non-Sterling	27,541	61.3	28,525	60.5	23,546	62.6
O.E.C.D.	17,958	40.0	19,926	42.3	15,197	40.4
Dollar area	3,427	7.6	2,268	4.8	2,384	6.3
Other non-sterling area	6,156	13.7	6,331	13.4	5,965	15.9

*Excluding N.A.A.F.I.

Areas	1958	1959	1960	1961	1962	1963	1964
All Currency Areas	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Sterling Area	36.7	37.1	38.2	40.3	48.8	44.8	44.9
United Kingdom	33.3	33.8	34.6	36.2	45.7	41.5	40.8
Other	3.4	3.3	3.6	4.1	3.1	3.3	4.1
Non-sterling Area	63.3	62.9	61.8	59.7	51.2	55.2	55.1
O.E.C.D.	51.6	48.1	45.8	41.5	38.2	40.8	40.1
Dollar	6.6	5.6	3.2	3.0	2.7	2.2	3.4
Other	5.1	9.2	12.8	15.2	10.3	12.2	11.6

*Source: (17).

unavoidable time trend is greatly reduced in its significance. Very few of the stochastic equations included in this study show significant correlation with time.

The pattern of growth in GNP over the period 1951-1964 is shown in Fig. 2. The boom of the first half of the fifties is due to the massive inflow of British funds for the construction of two large military bases as well as the colonial administration's vain efforts to suppress the Cyprus rebellion. Per capita real gross national product rose from £ 81.6 mill in 1950 to £ 109.0 mill in 1957.* The retail price index rose from 65.3 in 1950 to 105.6 in 1958 (1957 = 100).

Taking the amount spent by the Military Authorities in 1950 as 100.0, military expenditure rose in the following index form during subsequent years (19): Military expenditure declined to a neglible amount during the period 1959-1963.

1950	100.0
1951	109.6
1952	305.9
1953	314.7
1954	449.3
1955	702.5
1956	1,419.9
1957	1,112.5
1958	1,086.7

*All value figures are given in pound sterlings, where 1 = $2.80.

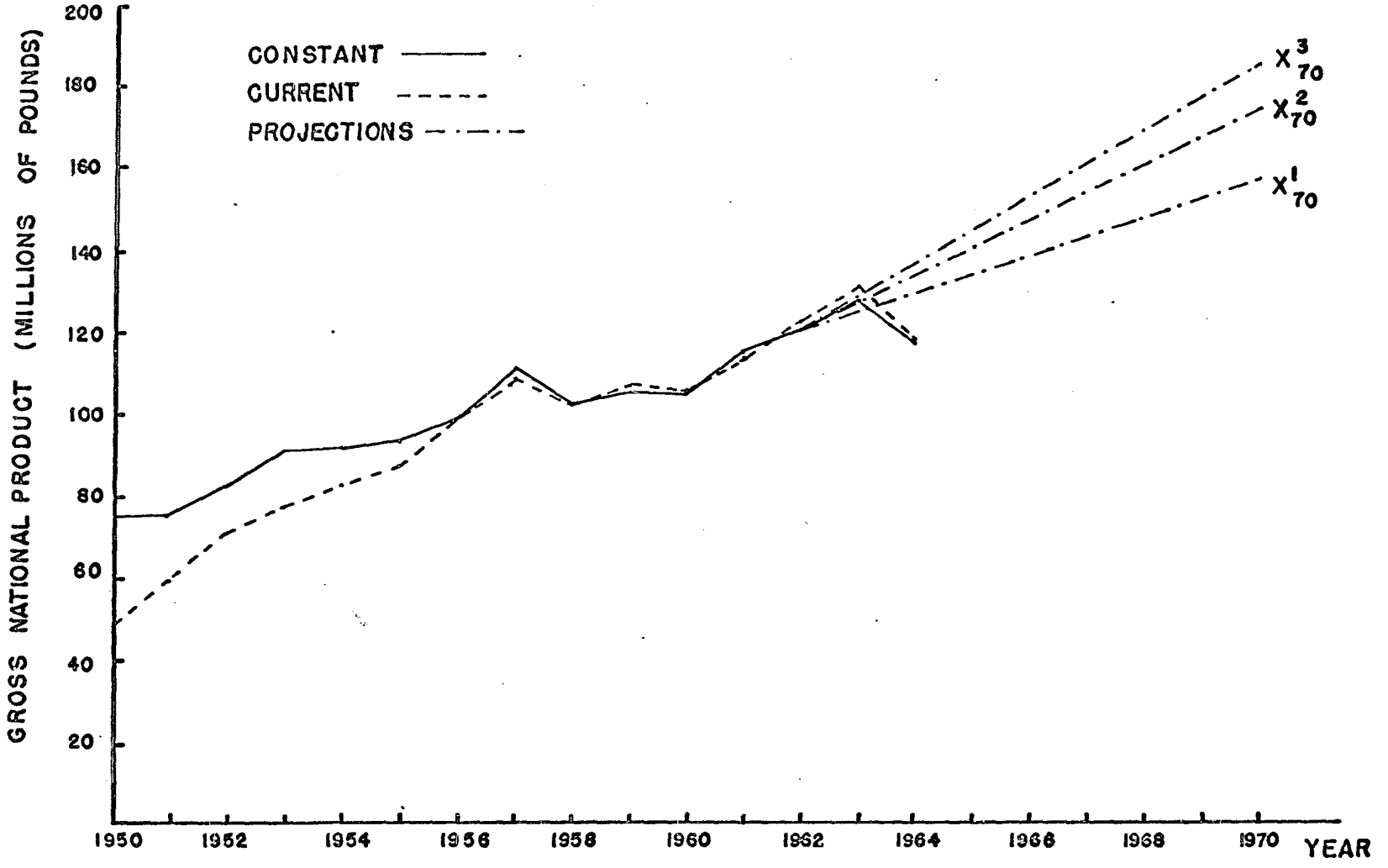

FIG. 2 GROSS NATIONAL PRODUCT AT CONSTANT (1958) AND MARKET PRICES PROJECTIONS TO 1970

This military expenditure can be roughly allocated to the following heads:

	percent
Direct Service expenditure (not works)	10
Works expenditure (local)	50
Civilian pay (not works)	15
Service pay (local spending)	25
	100

The large increase of domestic demand that followed the massive inflow of foreign funds was satisfied by increasing imports and inflationary pressure on domestic supply of housing and food. The merchandise import-export deficit grew from £ 2.51 mill in 1952 to £ 15.74 mill in 1957. The government transactions' contribution to the credit side of the current account of the balance of payments rose from £ 4.16 mill in 1952 to £ 20.31 mill in 1956, a spectacular increase when considering that the corresponding gross domestic product was £ 38.7 mill and £ 80.8 mill respectively at current prices.

The sudden reduction of government expenditure and the uncertain political future of the island precipitated the depression of 1958-1960. However private consumption was maintained buoyant during the period and exports edged upward. Investment started to decline after 1957 due to the completion of the major part of the British bases construction works. The continuous state of emergency necessitated a high defense component in government demand which partly offset the decline in construction at that time. The depression reached "bottom" when the defense expenditure

declined radically in 1960 accentuated by the uncertainty over the political future of the island. The decline in government consumption expenditure was sudden, dropping more than 40 percent from 1959 to 1960. The almost simultaneous decline of two major exogenous factors (I and G_C)*, reinforced by a joined multiplier-accelerator effect, explains well the depression of the late 50's. Thus a period of continuous growth, wholly externally managed and induced, came to an end. An analysis of the impact on Cyprus development during the last 10 years of the British administration would greatly facilitate a better insight into the process of development when induced externally in such major proportions.

The impact of the establishment of two large military bases and the continuous presence of thousands of British troops and their families had, besides the direct economic effect, significant demonstration effects.** The establishment of the British bases had what Hagen termed a cultural "shock", a sort of demonstration effect of international proportions (53). In terms of infrastructure (investment in agriculture, tourism, or manufacturing), the British build-up had only secondary stimulating effects. The absence of a comprehensive development plan and the completely market oriented economy prevented the necessary rate of investment of the appropriate kind (agriculture, tourism, manufacturing, trade) from taking place.

The immediate impact of the massive inflow of foreign funds was the rapid increase in consumption which could be easily satisfied by imports

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*See definitions of variables, pp. 39, 40.

**The 1960 census reports 3.0% of the population to be British.

from England, Cyprus being, in reality, an extension of England in the Mediterranean. Thus private consumption rose in spite of the overall declining level of economic activity in the period 1958-1961, giving a very high MPC (marginal propensity to consume) for that period. Orthodox economic development theory considers such non-austerity inimical to growth. The classic decision, and the one which every economy must face between consumption and investment, was answered heavily in favor of more cars, radios, television and better present living in Cyprus during the '50's. The sacrifice of present consumption for more future consumption did not take place in Cyprus. The merchandise deficit on current account grew from £ 0.14 mill in 1950 to £ 20.07 in 1957. The total of consumer good imports M_C (see definition of variables) was 46 percent of investment good imports, M_I for the 1951-1952 period. For the period 1957-1958, $\frac{M_C}{M_I} = 1.02$ or that is, consumer goods imports surpassed the imports of investment goods. The significance of M_I to domestic production is clearly indicated by the domestic production equations of the models presented, particularly in manufacturing and agricultural production. The lower share of M_I to M_C shows how no basic transformation was brought about in production. Higher levels of domestic production would have been expected to bring about a higher proportion of raw and investment material inputs under structural transformation. A clearer indication of the lack of any basic transformation over the 1954-1957 period is given by the S. Vassiliou Input-Output tables (76, pp. 85-88). The 1957 interindustry flow shows very minor linkage between sectors. The heavy dependence of manufacturing on imported raw materials and large imports of fertilizer into agriculture,

primarily for cereal production, is clearly seen. Also activities such as construction, furniture, wearing apparel and grain mill products show heavy dependence on imports, as well, for their inputs.

A. Hirschman, in his The Strategy of Economic Development (60) presents the lack of interdependence and linkage as one of the most typical characteristics of underdevelopment. The scarcity of linkage effects is a major weakness of the Cypriot economy. In the years following 1957, the intersectoral linkage has increased as can be judged from the number of new industries established. The construction of an input-output table of a recent period (preferably the year 1963) can best show the structural change which would have taken place in recent years. The 1961-1963 ratio of $\frac{M_C}{M_I} = 1.01$ does not indicate any significant structural transformation. On the other hand, the larger number of domestic industries indicates a high share of domestically produced goods previously imported. Table 2 shows the contribution of eleven sectors to gross domestic product in 1958 and also in 1963. No significant structural changes can be detected. The increase in the share of agriculture is due to the exceptionally favorable weather conditions which may therefore overshadow the increased contribution of manufacturing.

One is tempted to brand the absence of development policy during the fifties and the consumption oriented growth of demand that followed as responsible for the inadequate structural change and development. To a great extent this is undoubtedly true, but one must be careful in branding such "non-policy" with no merit or positive effects on development. Unquestionably a more optimum use of such massive inflow of foreign exchange

Table 2. Share of each sector in the gross domestic product at constant factor cost*

Sectors	1958	1959	1960	1961	1962	1963	1964
Agriculture, forestry, fishing and hunting	19.2	20.5	19.5	22.7	22.3	21.5	22.5
Mining and quarrying	8.2	8.1	8.4	6.6	5.7	5.5	4.6
Manufacturing	11.5	11.7	12.7	13.0	12.8	12.9	14.2
Construction	8.5	5.8	5.9	7.1	7.6	9.3	6.0
Electricity, gas and water	1.6	1.7	1.9	1.9	2.0	2.0	2.3
Transport, storage and communication	10.5	11.0	11.2	11.2	11.3	11.4	11.3
Wholesale and retail trade	11.1	11.2	11.2	11.2	12.1	11.7	11.9
Banking, insurance and real estate	1.8	1.6	1.9	1.9	2.0	2.3	2.4
Ownership of dwellings	9.2	9.3	9.5	8.6	8.4	8.3	9.9
Public administration and defence	8.3	8.7	6.5	5.0	5.2	4.9	4.9
Services	10.1	10.4	11.3	10.8	10.6	10.2	10.0
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

*Source (17, p. 25).

from a highly industrialized nation such as Britain could have been made. We can only speculate how a central plan and the appropriate economic policy could have directed expenditure into sectors of more lasting benefit to the economy. Though when we look at the four years of independence (1960-1963) and the beneficial results of comprehensive planning of the tentative kind, we cannot help but be impressed with the beneficial effects of planning. The issue, as to the relative efficiency between planning and non-planning (leave it up to the market), is not clear.* The case of Cyprus during the 1950-1963 period provides some relevant insights for this debate. A strong case can be made from the Cyprus experience that the period of the early '50's formed the socio-economic foundation of future development on which economic planning at a later date could succeed. A case can be made that the autonomous rise in demand spurred by the British spending was the main inducement to domestic development through increased domestic production.

The theoretical implications of such consumption oriented behavior are of interest to the analyst. Development cannot be meaningfully dichotomized as supply oriented or demand (consumption) oriented, when we speak of the past performance of an economy. In an ex-post sense supply equals demand. However, the dynamic forces that precipitate development are the major concern of economic development theory and in this sense the deflationary or inflationary disequilibria that take place in the early stages of development are very significant in the adequate understanding

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*For a discussion on the relative merits of planning and some of the issues involved in comparisons with no planning, see (96).

of growth. In this latter sense the consumption oriented Cyprus economy proved conducive to economic development. The availability of imports and the introduction of already existing innovations, especially during the early '60's, made possible what is often referred to as derived development. In Cyprus, once higher consumption patterns were realized, the consumers resisted a return to previous lower consumption levels, as demonstrated by the low and negative marginal propensities to save during the period of 1958-1961. Thus, strong pressures for domestic development were unleashed in a consumer-demand oriented economy.

Having tasted a more affluent style of living, the Cypriots would not allow it to deteriorate. The intensity of the desire to develop was strengthened with beneficial future results. The taste for refrigerators, as indicated by increasing imports, induced a local producer to attempt their production, a now successful enterprise. The taste for high grade ice cream had the same effect. The rising meat imports prompted the establishment of a very successful broiler industry. Perhaps it is too much to suggest that a consumption oriented economy in the early stages of growth is conducive to long run development, but in the Cyprus case, the "uneven" growth of consumption suggests that this may be a special case of unbalanced growth, where instead of public utilities inducing growth, the need for better and fancier consumer goods does the same thing.

Inflationary gaps, relative to domestic supply, are not in themselves sufficient to generate development. We would expect a lag in the response of domestically generated supply, and if, as in the case of Cyprus, imports are freely available to satisfy demand, the incentive for domestic

development will be greatly reduced. The need for adequate public policy to direct public and private investment to domestic production that can satisfy the growing demand is a paramount requirement under these circumstances. The period of the early sixties well satisfies this requirement.

In 1960 Cyprus became a Republic with her own government and a unique sort of constitution. The years 1960-1963 were ones of growth and exceptionally good economic performance. Gross capital formation at constant prices increased from £ 14.5 mill in 1960 to £ 24.0 mill in 1963. Gross national product reached the level of £ 127.4 mill, the highest ever. The renewed confidence in the future of the island, together with a rapidly expanding tourist trade, were the major causes of the recovery. The most important considerations for the successful performance of the early '60's must center on two factors--the civil service left to Cyprus by the previous British administration, and the sound economic management on the part of the Cyprus government. A major contributor to the latter have been the suggestions for the economic development of Cyprus made by the United Nations' Willard L. Thorp Mission (95). We will not attempt here to justify the belief that the Thorp report played a most important role in the successful Cyprus development of the early '60's. It suffices to say that the apparently successful first five year plan followed very closely the Thorp suggestions. The success of such missions is not always clear, partly because their policy recommendations are far from sufficient conditions to development. In addition non-economic prerequisites to growth are missing and an economic mission, regardless of how good and well meant, can do little to alter the basic institutional

structure of the country under consideration. Further, suggestions and programs for development are only as effective as the implementing authority allows them to be. The Thorp suggestions were well received and the Cyprus government sought to carry them out at once. Because of the importance we give to the Thorp Mission in Cyprus development during the period, the formal terms of reference of the Mission are quoted below:

> "The basic purpose of the Mission is to make an independent and objective study of the economic prospects for Cyprus in the light of its resources, and to prepare recommendations to the Government of Cyprus for action looking toward the acceleration of its economic development. While the two months' period will not permit the preparation of a full-scale economic plan in much detail, it is our hope that it will be possible, within that period, to draw the main lines of an economic program which will lead to the appropriate development of agriculture, industry, and other economic activities, aimed at providing additional employment and increased national income. Particular emphasis will be given to problems of investment needs and possible sources of funds, and to such institutional arrangements as appear to be desirable."*

The government economic development policy followed the Thorp suggestions closely with major emphasis in agricultural investment, water development and tourism. The results of that economic policy have been excellent, blessed with political stability, ample tourism and good agricultural production. The Cyprus economy reached its highest level of performance in 1963 (28).

Yet man, who is rapidly learning to control his physical and economic universe, has not learned to manage himself. The eruption of communal strife late in 1963 due to the antagonisms between the Greek and Turkish

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*For a comprehensive survey of government policy during the 1960-1963 period, see (88).

population of Cyprus, brought to an end the period of economic expansion. Gross national product declined by 8.8 percent at constant prices during 1964. Economic activity was paralyzed during the first quarter of 1964. The subsequent presence of the United Nations Peace Force brought relative peace to the island and though the political problem has not been solved, the economy returned to normal. The rate of growth has resumed its previous pace for 1965 and 1966.

CHAPTER III. AN ECONOMETRIC STUDY OF THE ECONOMY

Formulation of the Economic Policy Problem

Formally, the economic policy problem of the type under consideration can be stated as follows:

The economic system is observed (ex-post) at an equilibrium, expressed by the equations of the econometric model. The condition for equilibrium is that aggregate demand equals to aggregate supply. We state the ex-post aggregate economic equilibrium as:

(1) $F(Y) = 0$

where Y, a vector of endogenous variables (dependent) such that

(2) $Y = f(X)$.

X is a vector of exogenous variables (independent).

It is the objective of economic policy to displace the economy from the prevailing equilibrium to a new equilibrium, judged desirable on the basis of a welfare function so that we can write:

(3) $\frac{\partial F}{\partial Y}\frac{\partial Y}{\partial X}dX + \frac{\partial F}{\partial X}dX = 0$

for the displacement to the new aggregate economic equilibrium.

From (3), we derive

(4) $\frac{\partial Y}{\partial X} = -\left[\frac{\partial F}{\partial Y}\right]^{-1}\frac{\partial F}{\partial X}$ or $F^{*}(Y,X) = 0$.

In the language of economic policy, one or more of the elements in X are under the control of the policy maker and are called instruments, X^{*}, while one or more of the elements in Y are the objective of economic policy, entering the objective function W, with an appropriate weight and are called targets, Y^{*}.

The change in the values of the variables X, normally displace the values of the endogenous variables Y, to a new equilibrium via a transformation by a matrix of appropriate order, the coefficients of which are called multipliers. The displaced equilibrium (values of endogenous variables) maps through the welfare function W, into the real line values, the extremization of which becomes the objective of economic policy.

In the linear equation case pioneered by Tinbergen, the policy problem reduces to

$$\text{Max (or min) of } W(y^*)$$

subject to

$$Y = B^{-1} FX + B^{-1} K$$

such that, all feasibility conditions are satisfied (i.e. values of instruments, saving = investment, external balance, etc.).*

The approach followed has been to project on the basis of a number of vector values of exogenous variables and select the projection vector of endogenous variables that appears more reasonable on the basis of past performance (output-capital ratio). The projected rate of growth in aggregate output is used, to give consistent estimates of the values of the other variables. One can also assign a desired value of output (GNP) at the end period and solve for the value of the appropriate policy instrument consistent with the target value. Additional use of aggregate econometric models can be made when using the forecasted values given by the model as the final demand components of an input-output table. To the

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*For a review and an appraisal of the Tinbergen approach to economic policy see (50).

extent that the relevant data is available, interindustry flows, consistent with the projected final demand vector, are estimated and a more disaggregated description of economic activity can be given.

General Characteristics of the Models

Nerlove suggested three accomplishments of aggregate econometric models of the type presented (77b):

a) a useful survey of the past--a more precise but limited form of economic history,

b) a means of clearing the economic inter-relationships,

c) a way of revealing the limitations of available data and thus pointing the way to more and better useful data gathering.

This study hopefully accomplishes all three and more. At the same time one should keep Theil's reminder in mind--that an econometric study is mostly an essay in persuasion (91).

From the various models considered, four evolve as the most reasonable for purposes of projection. These are 36-S, 32-S, 32-Y_G and 29-S. The difference in projected values among the various models demonstrates how ssuch tools of analysis must be treated with caution and cross examined on the basis of alternative economic considerations in addition to customary statistical evaluation. When forecasting from estimated statistical economic relationships, as done through the models, it is often the case that a forecast is obtained which is far from what is considered "reasonable". Several decision rules can be applied by which the term "'reasonable' forecast" is chosen.(102). The decision rule used here is based on the

incremental capital-output ratio of recent years. The choice of the endogenous slack in the model seriously affects the projected results as can be seen from Appendix B.

Equation 3, p. 21 introduces a redundant equation into the model. If $Y_{Su} \equiv Y_D$, for the matrix of the endogenous variable coefficients to have an inverse ($BY = FX + K$), a slack variable on either Y_S or Y_D must be assigned.

For the years '59, '60, '63 and '64 for which the exogenous variables are actually observed, the Y_{Su}(GDP) is close to Y_D. The two Y's, however, diverge significantly when projected into 1970, calling for values of the slack variable in some cases too large to be realistic. The forecasting, both in the sample period and beyond, is done in an ex-ante sense, while the equilibrium requirement, $Y_D \equiv Y_{Su}$ is an ex-post logical requirement of the type--what is sold is what is bought. The forecasting, on the other hand, is based on estimated behavior equations, and the discrepancy, $Y_{Su} \neq Y_D$, is to be expected. The introduction of a slack variable in either Y_D or Y_{Su} which is defined in terms of the other variables assures that the equilibrium condition will always be satisfied. The equilibrium condition, as introduced in the model, is a logical requirement, and the economic interpretation of the forecasted results must be reconciled with it.

The choice of endogenous slack yields corresponding values of the endogenous variables. This is not uncommon in economic theory and the familiar Patinkin controversy is a case in point (75). A linear simultaneous system of equations can be consistent having at least one solution. However, the solution of the system guaranteed by the "counting rule"

(number of equations equal to the number of unknowns) may not be economically meaningful. The task is to select that endogenous slack that gives reasonable results in view of knowledge about the economy.

From the several projections made both on the basis of different sets of exogenous variables and a different slack, the ones are chosen that give feasible results. The choice of feasible is based on

a) the projected growth rate in GNP

b) the values of endogenous variables.

The demand deficiency as it appears in the projections on the basis of Y_{Su} suggests that Nurske's concern with inadequacy of real demand in developing countries is a valid proposition (78). The core of Nurske's argument is fundamentally a special case of Keynesian demand deficiency due to the unbalanced nature of development. In other words, those who earn income in one industry will not be expected to spend their entire income on the products of that same industry or the presumably very limited number of other industries. One cannot easily reconcile the Cyprus case to the above theoretical considerations since the ample availability of foreign exchange would satisfy demand througn imports. In the model a high level of projected domestic output brings about correspondingly higher imports but a lower domestic product. This is due to the exogenous nature of exports and limited import substitution effects incorporated in the model. That is, the increase in domestic production is not linked adequately to domestic demand. The projections with S as the endogenous slack variable give reasonable results from both the demand and supply side of the model. Model 36-S incorporates more equations and introduces more interdependence than any of the other models. The major part of the

analysis is concentrated on the results obtained by the use of model 36-S. An alternative formulation of this model is used in the linear programming analysis discussed in Appendix A.

A mathematical exposition of the balanced-unbalanced aspect of growth is given by Sengupta and Thorbecke (87). In their approach they introduce several types of response functions by which total or potential equilibrium is secured at intermediate or end time periods.

Unbalanced growth is an essential characteristic of economic development and the difference of view as to its relevance in development planning is more one of degree relative to the time interval over which balance is to be accomplished. In a most fundamental sense balanced growth cannot be understood apart from unbalanced growth.

The usual demand estimated aggregate econometric models do not render themselves to demand-supply discrepancies, in the ex-ante sense, since the supply side is missing from the model. Though the model presented is of the demand and supply kind no attempt is made to introduce explicit relations that would form an equilibrium. A step-function can be defined specifying the extent of unbalanced growth (discrepancy from the balanced path). Such a function can be a piecewise continous function over time, when the total time interval t is subdivided into intervals t_1, t_2 up to $t_n = 1970$, at each of which the function takes a jump (87).

The difficulty with such an approach lies in the a priori choice of the balancing function that must be specified ex-ante with no guarantee that the actual responses to the discontinuities of the growth process will follow the prescribed adjustment. The dilemma is one of lack of available theory that can predict the adjustment process. The specific form of the

adjustment function can hopefully be approximated when given a sufficient theoretical understanding of the growth process together with an intimate knowledge of the economy. Due to the highly dependent character of the Cyprus economy on the foreign sector it can be safely suggested that the inevitable inbalances will be satisfied in the export-import sectors. In this respect the Cyprus experience would be similar to the British as understood by Scitovsky, where the classic case of British industrialization has been one of unbalanced growth of output in the domestic sector converted into a balanced pattern of product availabilities by means of foreign trade (87).

The inequality coefficient U, for forecasted GNP by model 36-S, is equal to .01822 for the years 1959, 1960, 1963 and 1964. U is defined as

$$U = \frac{\sqrt{1/n \sum (GNP_{i-F} - GNP_{i-A})^2}}{\sqrt{1/n \sum GNP_{i-F}^2} + \sqrt{1/n \sum GNP_{i-A}^2}}$$

where, GNP_{i-A}: actual GNP at year i,

GNP_{i-F}: forecasted GNP, via the model, at year i. The closer U is to zero the better the forecast.

Only the inequality coefficient of model 28-DY is smaller, that being equal to .00398. On the basis of past performance, the projected average rate of growth in real Gross Domestic Product is expected to be between 5 to 6 percent per annum.* Assuming constant net transfers to factors from abroad, the Gross National Product for 1970 should be:

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*See pages 29, 30.

$GNP_{70} = 120.7\ (1 + .05)^8 = £\ 178.3$ mill at 5%

$GNP_{70} = 120.7\ (1 + .07)^8 = £\ 192.4$ mill at 7%.

From the models investigated, 36-S, 32-Y_G , 32-S and 29-S, all give reasonable projections in terms of the values of projected GNP and endogenous slack. The projected growth rates are estimated by the use of output-capital coefficients following the Harrod-Domar formulation of the problem of growth.* The projections above are estimated on the basis of the 1961-1963 average GNP.

Feasible Growth Rates

Assume a constant marginal propensity to save, a. Assume also a constant capital-output ratio, K. Then the necessary rate of growth of investment (addition to capital stock) is a constant equal to aK. The proof of this is simple. If one dollar's investment adds K dollars of added capacity to produce, then the cumulative investment of any period adds capacity worth Ki_t. The additional aggregate demand required to use the newly created capacity must then be also Ki_t for the aggregate economic equilibrium to be at full employment (assuming we were at full employment at t-1). Added consumption can account for $(1 - a)\ Ki_t$ of the added capacity. The balance aKi_t must be "offset" by additional investment demand. That is, tomorrow's investment demand, i_{t+1} must exceed today's i_t, by the amount aKi_t or

$$\Delta i = aKi_t \qquad \text{and} \qquad \frac{\Delta i}{i_t} = aK.$$

---

*As formulated by Ackley, G. (1, pp. 513-529).

For purposes of growth estimation in an open economy,

$a = \frac{\text{net investment}}{\text{gross domestic product}}$ and the supply of output rather than demand becomes the limit to growth. So that

$$\frac{\Delta Y}{Y} = \frac{\Delta GDP}{GDP} = \frac{\text{Net Invest.}}{GDP} \times \frac{\Delta GDP}{\text{Net Invest.}}^{*} = aK$$

This method in deriving the possible growth of an economy is only a first approximation and must be interpreted with caution.**

The vector of exogenous variables, X^{3}_{70}, given in Table 41, was used for projection in the endogenous variables of model 36-S. The values of the endogenous variables are given in Table 5a.

Gross National Product reaches £ 184.14 mill or what it amounts to, a 5.5 percent average yearly increase in constant prices. Such a rate is well within the capabilities of the economy as evaluated by its early 1960's performance. For Cyprus in the period 1960-1963, judged to be a normal period in view of future development, we have

Year	I_{net}	Y	ΔY	$K=\frac{\Delta Y}{I}=.53$	$a=\frac{I_{net}}{Y}=.12$
'60	9.8	101.2	-	-	.0967
'61	10.8	110.1	8.9	.825	.0980
'62	15.8	115.3	5.2	.329	.1370
'63	18.5	123.3	8.0	.432	.1500

from where K = .53 and a = .12 so that

$$\frac{\Delta Y}{Y} = \frac{\Delta Y}{I} \times \frac{I}{Y} = aK = .12 \times .53 = \text{App. } .064 \text{ or } 6.4\%.$$

---

* where $\frac{\Delta GDP}{\text{Net Invest.}}$ the incremental output-capital ratio.

** For an application of this method in the derivation of operational and quantitative aggregate growth ratio, see (93).

It is reasonable to assert, from the performance of the 1960-1963 period, that the average annual growth of GNP in the near future should be in the range of 5-6 percent when account is taken of (a) the subsequent political uncertainty, and (b) the general expansion during the period 1960-1963 which may overestimate the growth possibilities in the economy.

Note, also, that the ex-post K, when applied for the derivation of projected growth, is assumed to be estimated over years of full employment when the potential and actual output are the same. If this requirement is not satisfied, and it seldom is when account is taken of the prevailing underemployment, the estimated growth rate (aK) underestimates the potential rate. On the other hand, the pressure of demand may be forcing the economy on its production possibility curve given the prevailing structure of the economy and stage of development. In the potential expansion of the productivity frontier, however, lies the main difficulty in using information from the past in order to forecast the future. By definition a developing economy is one where structural change is underway and thus the continuous expansion of the production possibility frontier is to be expected under conditions of dynamic development.

A major assumption and inevitable shortcoming of any such growth projections is that the prevailing structure between the economic variables introduced in the model will remain constant. Such an assumption rules out any reorganization in production which can greatly alter the performance of an economic system. It is entirely possible that a major reorganization of the Cyprus governmental machinery, for example, can bring about substantial productivity gains to the economy while remaining at the same levels

of traditional marketable inputs. To point out possible efficiency variations under similar labor capital inputs, Leibenstein, in a recent article, introduces the concept of X-efficiency which he interprets as (a) intraplant motivational efficiency, (b) external motivational efficiency, and (c) nonmarket input efficiency (72). At the plant level, cost reducing methods adopted by firms in developing countries, without additional capital inputs, increased productivity by as much as 500 percent. On the whole, these improvements involved plant layout reorganization, waste control, work method payment by results, accounting systems and the like. One should expect considerable room for such x-efficiency improvements in developing countries everywhere.

The cautious use of capital-output ratios of the type here employed is emphasised by Leibenstein. He reasons "plausibly but not necessarily" to give evidence taken from a number of countries that incremental capital output ratios and growth rates are inversely related in the short run (73). He points out that we should expect an inverse relationship between observable incremental capital-output ratios and growth rates for the following reasons:

(1) the investment rate is a more stable variable than are other variables affecting growth,

(2) the significance of non-capital inputs is greater than that of capital inputs,

(3) changes in the level of employment of all inputs affect growth more than investment, and

(4) some outputs are related "probabilistically" to inputs.

The comments made by Leibenstein, especially point 2 above, should caution the dogmatic interpretation of the conclusions on potential growth rates for the Cyprus economy. Instead, the derived rate of growth is used as suggestive and as a plausible expectation of short run future development.

There is no labor explanatory variable incorporated in the model. Labor statistics of good quality were available only for few recent years. Labor estimates used for a number of sectors did not yield satisfactory results in the estimation. The omission of labor from the model may not be a serious one if account is taken of the prevalant underemployment in the economy and the small size of the island. The characteristic dualism of underdevelopment is found in Cyprus--productivity in the agricultural sector is low and while it is high in manufacturing and urban activities, as seen by the low agricultural incomes. Dualism is not found only between the agricultural and non-agricultural sector. Both within the agricultural and non-agricultural sectors we find wide divergencies in productivity. The size of manufacturing establishments in Cyprus, strongly suggests dualism in manufacturing in terms of the very wide range in size of similar product plants. In agriculture, certain export oriented activities are very productive in comparison with the traditionally small lot farming. It is estimated, for example, that a large plantation west of Limassol in southern Cyprus, produces 45 percent of the fresh grape export of the island.

The mobility of labor is assisted by the good system of roads in the island, but more so by the small size of the country which often permits the commuting from the village to urban jobs. The existence of underemployment and labor mobility would suggest that labor shortage is not the

constraint to Cyprus development. Structural transformation, on the other hand, will require skilled labor which is not presently available. The shortage of jobs requiring academic qualifications, especially of the technically trained for executive posts, is particularly acute.* The relatively high level of education and the small size of the country should be expected to accelerate the supply of skilled labor in response to demand conditions.

Investment Requirements and Projections

The scarce factor in Cyprus development is capital which is also seen as the major carrier of modern technology in the economy. Apart from the composition of investment on which more was said in the introduction, the total availability of investment must ordinarily satisfy the following equality:

$$S_p + S_g + B_{dg} + B_{dp} + B_{fg} + B_{fp} = I_p + I_g = I$$

where:

S_p = savings private

S_g = savings government

B_{dg} = domestic borrowing, government

B_{dp} = domestic borrowing, private

B_{fg} = foreign borrowing, government

B_{fp} = foreign borrowing, private

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*For more on the Cyprus employment situation, see Annual Report of the Ministry of Labour and Social Insurance, in particular for the year 1965, Nicosia, 1966. The Ministry of Labour has done an excellent job in recent years both in keeping all relevant statistics and in arbitrating labor disputes.

I_p = private investment

I_g = government investment

I = total domestic investment

In the model, three forms of investment are given, imported investment goods (I_{mp}), domestically produced investment goods ($I_d = I - I_{mp}$) and government investment (GI). No attempt is made to introduce the condition of the equation on p. 33 explicitly in the model. Suffice it to say that domestic saving is low, as the high marginal propensity to consume indicates. It is the difficulty with an open ex-colony, pluralistic highly unionized economy to favor consumption at present, than abstinence and investment, with hopefully higher levels of consumption later. In 1970, under projections X^3_{70} in model 36-S, gross domestic savings is given by:

$S = GNP - [C + G_C]$ or £ 34.11 mill.

The forecasted level of investment I, is £ 51.20 mill, so that £ 17.09 mill must be financed by borrowing domestically or from abroad. Cyprus is, in a way, fortunate when it comes to the availability of investment funds. As part of the British Commonwealth and an ex-colony, most of her banks are branches of London-based institutions which have the facility to extend loans in Cyprus at any time. The difficulty with such an arrangement is that the decision center is foreign to Cyprus, and a conflict between the foreign bank objectives and those of Cyprus development policy cannot be precluded. Also, the ease with which investment funds can come to Cyprus works in the opposite direction as well, with the outward flow of capital remaining an unhindered possibility at any time.

No investment equation is introduced in the model. Such an omission is common in models of this type. When investment is incorporated as an endogenous variable in similar studies, it is statistically one of the weaker equations of the model. Ordinarily this is a serious omission for two reasons:

a) the important role of investment in a developing economy,

b) investment equations via the interest rate provide the important link between monetary and real sectors and are thus a significant policy instrument.

One attempts to eliminate consequence (a), by the estimation of sectorial capital output requirements. The second consequence is not so important in the case of Cyprus since monetary policy is to a great extent exogenously controlled. The absence of exchange controls and the free convertibility of the currency in unlimited amounts and at fixed rates of exchange prevent effective control of the money supply. It should be emphasized that the absence of effective monetary policy, in a dependent highly open economy such as Cyprus, prevents the policy makers from having an effective instrument in influencing private investment. The government development budget acquires additional importance under such conditions. Speaking of policy instruments, one should note the many limitations placed on government policy in a small monetary dependent economy. Only the government budget (especially development expenditure), import restrictions through tariffs, and taxation policy are the significant policy instruments available, all of which appear in the model with their multipliers significant.

The sectorial investment requirements are not completely incorporated in the model supply equations. It is pointed out earlier that capital formation did not enter significantly the estimated regression equations. The importance of capital investment compels a closer examination and an indirect estimation of sectorial investment needs in order to arrive at total capital requirements. Capital must combine in assumed fixed proportions with other factors in order for the projected outputs to be realized. Table 3 gives capital formation by industrial use. This revised form of sectorial investment is very recent. On the basis of sectorial capital-output ratios for 1963, the projected investment requirements for 1970 (X^3_{70}) are £ 38 mill.

Such a projection is below the £ 51.20 mill anticipated in our projections (X^3_{70}) where gross capital formation is assumed to grow at 7 percent yearly rate. The capital-output requirements based on only one year (1963) can hardly form the basis for longer run projections. Also, not all sectors were adequately considered in the sectoral projections. It is to be noted, in addition, that the exceptionally high demand year, 1963, tends to underestimate the capital requirements that prevail in the economy in more normal times.

A number of investment equations are given in Appendix D. Equation 1 is of interest. It shows a negative coefficient associated with government emergency expenditure. The coefficient is significant enough to have captured the adverse effect that the unstable political situation of 1956-1958 had on investment. The emergency government expenditure was used to suppress the Cyprus rebellion and can be seen as an explanatory

Table 3. Gross capital formation by industrial use (at constant, 1958, market prices)[a]

Type of Use	Type of Capital Asset (£ million)								
	1963							1964	
	Total	Total %	Non-Residential Buildings[b]	Other Construction	Transport: Passenger Cars	Transport: Other Equip.	Machinery & other Equipment	Total	Total %
Agriculture	2.5	10.4	-	1.3	-	-	1.2	2.1	14.2
Mining & Quarrying	0.4	1.7	-	-	-	-	0.4	0.5	3.4
Industry	5.7	23.7	0.2	-	-	-	5.5	4.3	29.0
Transport and Communications	4.0	16.7	-	1.5	2.4	0.1	-	2.9	19.6
Distribution	2.1	8.8	2.0	0.1	-	-	-	0.8	5.4
Housing & Gov't Building	9.3	38.7	9.1	0.2	-	-	-	4.2	28.4
Total	24.0	100.0	11.3	3.1	2.4	0.1	7.1	14.8	100.0

[a]Source: (18, pp. 30, 31).

[b]Also includes dwellings.

psychological variable incorporating the effect of political tension on investment. Equation 5 with lagged investment as the explanatory variable gives the highest R^2.

An Interdependent Model and Econometric Forecasting

Model 36-S, made up of 36 equations, is given next. The other models are found in Appendix B. The structure of the model is followed by the forecasts of eleven important variables as given by Model 36-S and 28-DY together with the actual (observed) values of these variables (Table 5). Some general characteristics of the models are given in Table 4. Alternative projections to 1970 under different models for selected variables are given in Table 6. On the basis of past capital-output ratios and the potential growth rate derived on p. 29, models 36-S, 32-S, 32-Y_G and 29-S give the most reasonable projections. Model 36-S is used as the basic model in the analysis that follows. The exogenous variables used in forecasting via the model are given in Table 7.

Table 4. Main characteristics of the models presented in this study

Country	- Republic of Cyprus
Type of data	- Yearly data - major reliance on national income accounts
Period covered or used in estimation	- 1951-1963, unless otherwise specified
Method of estimation	- Ordinary least squares (OLS)

Number of stochastic and definitional equations = total equations, exogenous variables		Exogenous variables
Model:		
1. 28 - DY	14 + 14 = 28	20
2. 29 - S	15 + 14 = 29	20

Table 4. (Continued)

3.	32 - S	18 + 14 = 32	16
4.	36 - S	21 + 15 = 36	11

Main institutional, technical and behavioral equations

Model: 36 - DY,S

5 - production-supply: agriculture, manufacturing, construction, transportation, services
2 - consumption: total private consumption, tobacco
1 - capital depreciation
4 - import equations: beverages, tobacco and durables, investment and raw material imports, imports with domestic substitutes, other imports (residual)
1 - industrial raw materials as a function of imports
1 - agricultural raw materials as a function of imports
1 - communications investment (vehicles) as a function of imports
1 - taxes on imports
1 - excise taxes
1 - direct taxes

Theil's inequality coefficient (U), a measure of predictive ability of the model and of internal consistency

$$U = \frac{\sqrt{\frac{1}{n} \quad (GNP_{i-F} - GNP_{i-A})^2}}{\sqrt{\frac{1}{n} \quad GNP^2_{i-F}} + \sqrt{\frac{1}{n} \quad GNP^2_{i-A}}}$$

where: GNP_{i-A} = actual GNP at year i

GNP_{i-F} = forecasted GNP, via the model, at year i

		U
1.	27 - DY	.003977
2.	27 - Y_G	.028414
3.	29 - S	.020119
4.	32 - S	.021952
5.	32 - Y_G	.024775
6.	32 - G_C	.020518
7.	36 - DY	.018742
8.	36 - S	.018220

Definitions of variables:*

C_p	=	private consumption expenditure
D	=	depreciation
$\overline{FL}$	=	imported fuels and lubricants
$\hat{G}_C$	=	general government consumption expenditure
G_E	=	government expenditure
GI	=	government development expenditure (government investment)
GNP	=	gross national product
GR	=	government revenue
I	=	gross capital formation including change in stocks
$\overline{I}_d$	=	Non-imported investment goods ($I - I_{mp}$)
I_{mp}	=	imported investment goods
K_C	=	capital formation in construction
$\overline{LT}$	=	total number of lorries and taxis (stock)
$\overline{LTM}_{-1}$	=	bank loans to manufacturing (lagged), current prices
M_C	=	imports less M_I
M_{DS}	=	imports with domestic substitutes
M_I	=	investment and raw material imports
M_L	=	imports of beverages, tobacco and durables
M_O	=	other imports (residual imports mainly fuel and lubricants)
MR	=	value of industrial raw material imports
M_{VH}	=	communications, imports
NF	=	net factor income from abroad
NI	=	national income

*Values are in millions of pounds (£ 1 = 2.80) at constant 1958 prices, unless otherwise stated.

NI_{NA} = non-agricultural national income

RA = fertilizer imports, thousands of tons

RF = rainfall index, inches

$\hat{S}$ = subsidies

$\bar{t}$ = time in years

TB = domestically manufactured cigarettes in okes

T_D = direct income tax

T_E = excise taxes

$\bar{T}_{etc.}$ = government revenue from foreign and domestic loans, foreign and domestic borrowing

T_M = taxes on imports

$\bar{T}_O$ = other taxes (residual)

VH = licensed vehicles (stock)

X = exports of goods and services (excluding factor payments)

$\bar{X}_A$ = agricultural exports

$\bar{X}_{MN}$ = mining exports

$\bar{X}_O$ = other exports (residual)

$\bar{X}_T$ = travel contribution to balance of payments account (tourism)

Y_A = value added in agriculture

Y_C = value added, construction and dwellings

$\hat{Y}_G$ = value added, public administration and defense

Y_M = value added, manufacturing including electricity and gas

$\bar{Y}_{MN}$ = value added, mining

Y_S = value added, services including banking, insurance and real estate

$Y(Y_{Su}$ or $Y_D)$ = gross domestic product at market prices

Y_T = value added, transportation, storage and communications

Variables with hats (^) are used as endogenous slack.

Variables with bar (−) are exogenous or predetermined.

Table 5. Model 36-S

		RES	R^2	F	D-W
1.	$Y_A = 6.340 + 0.117\ RA + 0.331\ \overline{RF}_{-1}$	11	.75	16.33	1.99
	t 2.149 5.539 2.507				
2.	$Y_M = 6.852 + 0.494\ \overline{LTM}_{-1} + 0.651\ MR$	5	.97	70.45	1.47
	t 8.171 4.476 3.519				
3.	$Y_C = 3.816 + 0.131\ NI_{NA} + 0.244\ K_C$	10	.85	28.41	1.42
	t 2.231 5.688 4.350				
4.	$Y_T = 4.563 + 0.643\ M_{VH} + 0.4498\ \overline{LT}_{-1}$	10	.89	41.75	2.55
	t 6.558 3.474 7.671				
5.	$Y_S = -9.123 + 0.393\ (Y-Y_S)$	4	.91	40.72	2.66
	t -1.740 6.381				
6.	$C_p = -1.162 + 0.942\ (NI - .582\ T_D)$	11	.89	98.90	1.83
	t -0.138 9.945				
7.	$TB = -3.985 + 4.637\ C_p$	11	.60	16.60	2.04
	t -.042 4.075				
8.	$D = 1.379 + 0.0325\ GNP$	4	.97	150.07	3.02
	t 4.607 12.250				
9.	$M_L = -4.650 + 0.146\ NI_{NA}$	11	.85	61.92	1.52
	t -3.514 7.869				

Table 5. (Continued)

		RES	R^2	F	D-W
10.	M_I = -16.217 + 0.338 GNP t -4.143 8.832	11	.88	78.0	1.38
11.	M_{DS} = -7.798 - 0.405 Y_A + 0.218 Y t -3.325 -2.156 4.850	10	.80	19.59	1.28
12.	M_O = -15.261 + 0.298 NI_{NA} t -4.677 6.509	11	.79	42.37	1.13
13.	MR = -0.880 + 0.348 M_I t -.469 3.984	6	.73	15.87	1.41
14.	RA = -2.117 + 3.627 M_I t -0.230 7.154	12	.81	15.18	
15.	M_{VH} = 0.105 + 0.163 M_I t .142 4.221	11	.62	17.82	
16.	T_M = -0.736 + 0.318 M_C t -.516 5.226	4 ('58-'63)	.87	27.32	2.21
17.	T_E = 0.456 + 0.0047 TB t 1.677 6.733	4	.92	45.34	2.56
18.	T_D = -1.849 + 0.071 NI t -.881 2.88	7	.54	8.296	

Definitions:

19. $Y_{Su} = Y_A + Y_M + Y_C + Y_T + Y_S + T_M + T_E + Y_G + \bar{Y}_{MN} - (S)$ Supply

20. $Y_D = C_P + D + I + G_C + (X-M)$ Demand

21. $GNP = Y + \overline{NF}$

Table 5. (Continued)

22. $NI = GNP - (T_M + T_E + D) + S$

23. $NI_{NA} = NI - Y_A$

24. $DI = NI - .582\ T_D$ (due to unconventional direct tax structure)

25. $H = Y - Y_S$

26. $I = I_{mp} + \overline{I_d}$

27. $I_{mp} = 0.678\ M_I$ (average '60-'63)

28. $M_C = M_L + M_{DS} + M_O$

29. $M = M_L + M_I + M_{DS} + M_O$

30. $X = \overline{X}_A + \overline{X}_T + \overline{X}_{MN} + \overline{X}_O$

31. $B = M - X$

32. $GR = T_M + T_E + T_D + \overline{T}_O + \overline{T}_{etc.}$

33. $GE = \overline{G}_C + GI$

34. $GD = GR - GE$

35. $K_C = 2.027 + 0.538\ I$ (regres. '50-'63)

36. $GI = 0.216\ I$ (average '60-'63)

Table 5a. Actual and forecasted values of selected endogenous variables on the basis of models 36-S, 36-DY, and 2 -DY

Model	1959 F[a]	1959 A[b]	1960 F	1960 A	1963 F	1963 A	Actual Forecast 1964 F	Actual Forecast 1964 A
36-S								
Y_A	20.05	19.7	18.85	18.2	23.04	24.5	21.75	23.3
Y_M	13.49	12.9	13.57	13.6	16.20	16.6	15.71	17.1
Y_C	17.17	14.6	16.30	14.3	19.19	20.1	17.97	16.4
Y_T	10.58	10.6	10.00	10.4	12.78	13.0	13.53	11.7
Y_S	24.31	22.0	21.86	22.5	26.48	28.2	25.73	25.1
C_P	78.50	80.9	75.81	87.0	86.46	103.7	82.95	88.7
GNP	110.18	105.8	104.10	104.6	121.10	127.4	118.90	116.5
M	43.49	42.7	38.54	41.4	51.07	52.9	48.79	44.3
GR	28.54	27.60	24.05	25.13	25.90	26.42	20.16	.-.[c]
T_M	6.41	7.0	5.50	7.0	7.68	7.8	7.18	.-.
T_E	2.14	2.2	2.09	1.7	2.32	2.4	2.24	.-.
36-DY								
Y_A	20.49	-[d]	19.39	-	23.79	-	21.08	-
Y_M	13.73	-	13.87	-	16.61	-	15.36	-
Y_C	17.44	-	16.62	-	19.66	-	17.55	-
Y_T	10.68	-	10.13	-	12.97	-	13.37	-
Y_S	25.18	-	22.94	-	27.96	-	24.39	-
C_P	79.61	-	77.19	-	88.39	-	81.26	-
GNP	113.26	-	107.90	-	126.43	-	114.17	-
M	45.63	-	41.20	-	54.78	-	45.50	-
GR	29.90	-	25.52	-	27.63	-	20.24	-
T_M	6.76	-	5.93	-	8.25	-	6.62	-
T_E	2.18	-	2.12	-	2.37	-	2.21	-

[a] Forecasted values.

[b] Actual values.

[c] Repeat column as for model 36-S.

[d] ".-.", information not available.

Table 5a. (Continued)

Model	1959 F	1959 A	1960 F	1960 A	1963 F	1963 A	Actual Forecast 1964 F	Actual Forecast 1964 A
28-DY								
Y_A	Exog.	19.7	-	18.2	-	24.5	-	23.3
Y_M	13.5	13.9	13.6	13.6	16.8	16.6	14.9	17.1
Y_C	15.7	14.6	15.4	14.3	18.8	20.1	16.3	16.4
Y_T	9.7	10.6	9.9	10.4	13.2	13.0	14.3	11.7
Y_S	23.2	22.0	21.6	22.5	28.0	28.2	25.2	25.1
C_P	85.1	80.9	83.2	87.0	101.3	103.7	92.9	88.7
GNP	106.2	105.8	103.2	104.6	126.7	127.4	116.9	116.5
M	40.2	42.7	38.5	41.4	54.7	52.9	49.1	44.3
GR	27.0	27.6	23.0	25.1	26.3	26.4	20.1	...
T_M	5.8	7.0	5.6	7.0	8.2	7.8	7.5	...
T_E	1.4	2.2	1.0	1.7	1.9	2.4	1.9	...

Table 6. Alternative projections to 1970 under different models and choice of endogenous slack.

Model	Projection	Variable	
1. 36-S	X_{70}^{3}	GNP	184.14
		B	32.07
		X	75.14
		M	107.21
		GR	54.14
		S(slack)	19.23
2. 36-DY	X_{70}^{1}	GNP	226.73
		B	83.45
		X	51.17
		M	134.62
		GR	52.75
		DY(slack)	75.48
3. 32-S	X_{70}^{2}	GNP	186.83
		B	41.51
		X	64.71
		M	106.22
		GR	47.73
		S(slack)	11.70
4. 32-G_C	X_{70}^{1}	GNP	206.99
		B	67.53
		X	51.17
		M	118.70
		GR	48.20
		G_C	68.75

Table 6. (Continued)

	Model	Projection	Variable	
5.	32-Y_G	X_{70}^2	GNP	183.24
			B	35.09
			X	64.71
			M	99.80
			GR	45.08
			Y_G(slack)	0.25
6.	29-S	X_{70}^2	GNP	192.55
			B	47.41
			X	64.71
			M	112.12
			GR	49.54
			S(slack)	19.71
7.	28-DY	X_{70}^1	GNP	237.94
			B	85.47
			X	51.17
			M	136.64
			GR	52.00
			DY(slack)	73.32
8.	28-Y_G	X_{70}^2	GNP	178.18
			B	35.19
			X	64.71
			M	99.90
			GR	45.14
			Y_G(slack)	-25.81

Table 7. Model 36-S exogenous variables: projected yearly rates and 1970 levels

		Approx. rate (%) (1961, 1962, 1963 Average as Base)	Level 1970 (X^3_{70})	Comments
1.	RF_{-1}	--	18.2	(Average of 1951-1963)
2.	LTM_{-1}	16.5	26.26	(Based on '58-'62 rate)
3.	LT_{-1}	12.3	28.00	(Based on '58-'62 rate)
4.	Y_G	5.0	8.02	(effected by tenure increase of salary schedules)
5.	Y_{MN}	5.0	9.46	
6.	G_C	7.0	7.61	
7.	I_d	8.3	20.00	
8.	X	10.9	75.14	
	a. X_A	10.00	19.23	
	b. X_T	20.00	14.92	
	c. X_{MN}	5.0	12.77	
	d. X_O	11.4	28.22	(Based on '58-'62 rate)
9.	T_O	7.0	11.86	
10.	$T_{etc.}$	15.0	9.79	

Some remarks on the given projections of the exogenous variables are now appropriate. Income from travel (tourism X_T) is projected at an average growth rate of 20 percent. Because of the low base period, this rate is not unrealistic.* As discussed elsewhere, tourism is expected to

*X_T increased by 46 percent in the 1963 period as compared to 1962.

be one of the most significant sources of income for Cyprus in the near future.* Agricultural exports are projected at an average growth rate of 10 percent a year. The composition of Cyprus agricultural exports is a favorable one. Citrus products are currently the greatest source of revenue from agricutural exports and their importance is expected to increase in the future. A country highly dependent on food exports usually faces a long run relative decline in prices due to the low income elasticities for food. However citrus products and fruit in general have one of the highest income elasticities. Fox estimated the income elasticity for citrus and tomatoes to be equal to .42, which though low, is the largest of all food items considered (49, p. 127). The fluctuations in copper prices in addition to agricultural price fluctuations have a great effect on the Cyprus terms of trade.

The projection of "government other income" $T_{etc.}$, includes foreign aid, and foreign and domestic government borrowing. It is anticipated that this source of government revenue will grow at an average rate of 15 percent a year. The financing of some major projects of social overhead capital such as ports and the unexplored source of domestic government borrowing are here accounted for. Government expenditure appears underestimated at £ 31.85 mill, in view of a revenue of £ 54.14 mill in the projections. It should be remembered, however, that the direct tax equation included in the model anticipates the power to collect income tax by the national government treasury. Under such circumstances, government

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*See pages 139, 140.

investment and government consumption expenditure can afford a much larger increase than the one given here.

Policy Multipliers

Policy multipliers are often the most useful by-product of an econometric model from the policy point of view. A multiplier is a coefficient which when multiplied by a specific change in a variable (instrument) gives the change in another variable (target). The nature of the multiplier is the same as encountered in comparative statics and equilibrium displacement.

The nature of the multiplier is understood in the context of the specified time period and the simultaneous interaction among economic variables. If the interdependence of the system were eliminated, the multiplier would have been equal to the initial change. The multiplier is closely tied to the fundamental concept of the flow in economic activity.

Our model is not a pure demand model as is usually the case. It incorporates production equations. The projections with S as the endogenous slack, a variable which appears both on the supply and demand side of the model, reduce the model to one of the accelerator-multiplier type.

Policy multipliers in the Cyprus economy estimated from models 36-S and 32-S are given in Table 8.

One should be careful in interpreting multipliers such as the ones given in Table 8. It should be remembered that they are partial (ceteris paribus) multipliers and suffer from all the weaknesses of traditional

Table 8. Selected multipliers of the Cyprus economy

Variable (Instrument)	Multiplier on (target)		
	GNP	B (M-X)	GR
I_d	.97	.74	.19
G_C	.93	.65	.15
M	-.93	.35	-.15
I_{mp}	.97	.74	.19
T_D[a]	-.50	-.33	.91
GI[a]	.87	.60	.14
RF_{-1}	.48	.20	.07
Y_A	1.46	.61	.21
M_L	-1.44	-.01	.07

[a]Multiplier estimated from model 32-S, all other multipliers from 36-S.

partial static analysis. Also an econometric model includes only a small number (hopefully the most important) of relations among economic variables, so that the full range of the actual multiplier may be under or over estimated depending on what kind of relations are left out of the model. There is no a priori reason to expect the mutual cancelling of the omitted relations, but one would expect a tendency in that direction.

A good example of how multipliers can vary with different models is given when comparing results of models 36-S and 29-S. The multiplier of M (imports) on GNP, given by model 36-S, is -.93 while model 29-S gives -.80 for the same multiplier. A reason contributing to the smaller

multiplier of model 29-S is the inclusion of M_0 (other imports) explained by the exogenous variable VH (number of licensed vehicles) and thus not connected to GNP as it is done in model 36-S.

With the above in mind, we examine some multipliers of the Cyprus economy. The I_{mp} (imported investment goods) multiplier on B (the balance of payments deficit) is given as a plus .74, and that of M_L (beverage and durable goods imports) is minus .01. It is not to be implied that M_L is a preferable class of imports. The negative effect of M_L on GNP is so great (-1.44) that the reduction in imports (all imports) more than makes up the increase in M_L. On the other hand, I_{mp} has a positive effect on GNP equal to .97 and thus an increase in M associated with GNP results in a plus .74 of B, i.e. a deficit. If growth, is the objective of economic policy, I_{mp} should be encouraged and not M_L. What is shown here is no different from the intuitive truth that, at the limit, a country that consumes nothing will import nothing. It should also be noted that the full impact of I_{mp} on B is not shown, essentially because no import substitution effects other than of agricultural production (Y_A) are incorporated in the model.

The heavy dependence of Cyprus on imports is clearly shown again by the multiplier analysis. The export multiplier on B is only 0.35. That is to say an increase of X (exports) by one, reduces B by only .35. In tracing the impact of an autonomous increase in exports, we see that the increase in gross domestic product, GNP and non-agricultural income bring about a large increase in imports which in turn effect GNP and B as shown by the respective multipliers. Also note that X is exogenous and not

tied to GNP through behavioral equations of production. Such lack of interdependence underestimates the export multiplier on GNP.

The exogenous nature of exports was resorted to after the failure to obtain significant export equations. A list of the attempted estimations of export equations are given in Appendix D. Part of the difficulty in obtaining reasonable export equations is due to the small size of Cyprus exports and the rather elastic nature of export demand. Under high demand elasticity, one would expect supply limitations to form adequate explanation of exports. Only in the case of mining was this shown to be true. Surprisingly no relation was found between agricultural production and exports.

With exports strictly exogenous, a major link with growth possibilities is omitted from the model since a highly open economy is export-led in her growth. Allowance must be made for the role of exports in development. The imports of raw materials and GDP growth are understood to be closely linked to exports. The 1970 projections for exports are given at the annual rate of 10.9 percent while that for GDP is 5.5 percent, that is, a higher propensity to export is assumed in the future. This is reasonable in view of the composition of Cyprus exports and the low income elasticities of domestic demand for agricultural products. Anticipated increased production, especially in agriculture, must also be channeled to exports and foreign demand.

The direct tax multiplier is negative on GNP as expected, and of magnitude -.50. An increase in direct taxes reduces consumption which in turn reduces GNP. No indirect tax multiplier is incorporated in the

system. In order for a negative indirect tax multiplier to be shown, a tax incidence originated through price change must be included in the model.

The combination of multipliers and simultaneous variation in instrument variables is attempted next.

Case 1.

Assume GI (government investment) and T_D (direct taxes) are the two instruments. We want to know the combined multiplier effect on GNP. We have:

$$\Delta GNP = .87 \Delta GI - .50 \Delta T_D$$

That is a similar increase in both T_D and GI of one has a positive effect on GNP close to .4.

Case 2.

Assume GI, Y_A, T_D and M are increased by one. What is the effect on GNP?

$$\Delta GNP = .87 \Delta GI + 1.46 \Delta Y_A + .93 \Delta X - .50 \Delta T_D - .93 \Delta M$$

Or, that the joined effect on GNP will be 1.83.

Case 3.

Targets: Maintainance of present B and increase in GNP by £ 5 mill over the next year.

Instruments: T_D and M

Problem: Find the appropriate values of the instruments necessary to satisfy the prescribed targets.

The problem can be formulated as two equations and two unknowns.

(1) $\Delta GNP = 5 = -.93\Delta M - .50\Delta T_D$

(2) $\Delta B = 0 = .35\Delta M - .33\Delta T_D$.

In solving by substitution we get:

$T_D = -3.65$ (reduced taxes)

and

M = -3.43 (reduced imports) Note in this case how the use of import taxes, as the instrument for import reduction, will ease the effects of this policy mix on government revenue if import demand is inelastic. In view of the assigned targets both direct taxes and imports must be reduced.

Case 4.

Targets: Maintainance of present B and an increase in GNP by £ 5 mill and an unchanged GR (government revenue).

Instruments: T_D, M and Y_A

Problem: Find the appropriate values of the instruments necessary to satisfy the prescribed targets.

We have three unknowns and three equations.

$$\Delta GNP = 5 = -.93\Delta M - .50\Delta T_D + 1.46\Delta Y_A$$

$$\Delta B = 0 = .35\Delta M - .33\Delta T_D + .61\Delta Y_A$$

$$\Delta GR = 0 = -.15\Delta M + .91\Delta T_D + .21\Delta Y_A$$

The solution is:

$$M = -2.96$$

$$T_D = -.78$$

$$Y_A = 1.27$$

Similar joined multiplier effects can be worked out for other combinations of targets and instruments.

It is very seldom that one or the other target is aimed at, to the expense of the other. The specification of the appropriate mix of targets and policies is a major concern of economic policy (91). The problem is referred to in economic theory as that of welfare function specification and is dealt with in the field of welfare economics. A few remarks on this subject are appropriate in a study dealing with economic policy.

The Welfare Function: Some General Remarks

Jan Tinbergen, in facing the inherent difficulty involved in the choice of a welfare function by the policy maker, writes (97, pp. 11, 14):

> "If preferences are consistent, they may be represented by some central, all embracing, concept in the minds of the policy makers, which we usually call welfare or utility of the economy to which the decisions refer. This welfare concept will largely, but not always completely, coincide with a certain representative individual welfare concept . . . . There may be a certain degree of similarity between individual welfare functions and that of the policy maker. The more democratic is the community, the more will the citizens be able to further this similarity, with the proviso, that, for this comparison the representative individual defined in some reasonable way should be taken. It hardly pays, however, to make this definition more precise, since it is clear beforehand that the similarity cannot, and should not, be complete."

The difficulty is in effect twofold: (a) who is to specify the welfare function and (b) what kind of function should be specified (what welfare criterion should be used). Even if there is agreement as to the aims of economic policy (consumption, growth, price stability, balance of payments, etc.) the need for a welfare criterion on the basis of which the choice of welfare functions can be made remains. If we accept the policy maker, as presented above by Tinbergen, to be the proponent of public welfare, the policy maker needs explicitly or implicitly to assume a welfare criterion as a guide to his policy choice.

It can be shown rigorously that a solution to a society's economic problem given by a perfectly competitive economy is Pareto optimum. That is, the price and quantity vector resulting from the competitive equilibrium is Pareto optimum. Similarly, and with a number of additional assumptions, a vector of prices and quantities can centrally be assigned

which simulates the competitive equilibrium solution given to the economic problem by free markets (67).

A Pareto optimum is defined as a balancing vector (equilibrium) of choices $(x^1 \ldots . x^n; y^1 \ldots . y^m)$ such that there is no balancing vector $(\bar{x}^1 \ldots . \bar{x}^n; \bar{y}^1 \ldots . \bar{y}^m)$ for which

$$\bar{x}^i \underset{i}{\succcurlyeq} x^i \text{ for all } i$$

and

$$\bar{x}^i \underset{i}{\succ} x^i \text{ for some } i$$

where

$\succcurlyeq$: at least as good as . . .

and

$\succ$: better than . . .

which is to say that if the economy is at Pareto optimum then no rearrangement can give a consumer greater welfare and still leave all other consumers unharmed.

A most crucial assumption underlying the proof of the identity of competitive equilibrium to Pareto optimum and vice versa is the nature of the space in which we operate. The space is assumed to be additive. In the interpretation of the theory, the additivity assumption excludes from consideration a large category of economic activities, namely those where external economies or diseconomies are realized. For this reason, the operational significance of the Pareto optimum criterion is limited. A so restricted criterion as Pareto optimality can hardly be expected to be satisfied in the real world and be of direct relevance to public policies. Yet the need for an explicit criterion to guide the policy maker cannot be fully detached from Pareto optimum considerations.

Given the traditional limitations of the Pareto welfare criterion, one is tempted to suggest an approximation to it with hopefully more operational breadth. Economic policy can, at its absolute minimum, be assumed to provide only the class of goods and services where external effects are to be found (What the people cannot do for themselves, their government does for them.) Given that the policy maker is entrusted with a set of economic decisions, a welfare function specification must take place. The policy maker is in need of an explicit or implicit welfare criterion that must underlie his choice of a welfare function. A choice among presumably a number of available welfare functions, presupposes a criterion by which choice is to be made. In countries of non-authoritarian regimes one can suggest that a modified Pareto criterion guide public policy. The policy maker, (the carrier of the common good, as suggested by Tinbergen) interprets the wishes of the community but with the understanding that Pareto optimum considerations will guide his choice of welfare functions and policy so that consideration may be given to the interest of all groups in the economy. The policy maker will then interpret what is good for the community. If his interpretation is incorrect, the people will vote him out or revolt. The extension made is that the criterion guiding the policy maker in his choice be a Pareto criterion such that no one is made worse off because of the policy course followed, or in the operational sense, the harm done to an individual or a group of individuals be minimized via compensation, tax exemptions and the like.

For example, in Case One of our policy multiplier problem (page 54), the increase in direct taxes may be harmful to some. The policy maker may

justify such an increase in long run benefits such as social stablity, economic growth, etc., and thus consider his policy a benefit to all or of much reduced, in his view, harm to the unhappy tax payers. In the case of externalities, the role assigned to the policy maker as the interpretor of popular wish is not inconsistent with the Pareto criterion in the strict sense. The Pareto criterion does not account for such cases, so the field is left open for any role one wants to assign to those responsible in allocating economic resources in activities where externalities are involved. A large class of economic development policies fall in this category. The position expressed here is that the Pareto criterion is a relevant one within the domain of the policy maker's choice.

The policy maker relying on Pareto considerations for policy action would seek to compensate a group (political, ethnic, regional interest, etc.) whenever a policy makes one group better off at the expense of another. In practical politics a seat in the cabinet for a minority may compensate for a development policy that adversely effects that minority. One strongly suspects that the art of compromise so urgently needed in the immense change that development and modernization entail is little more than an implicit attempt to maintain Pareto optimality.

Model Evaluation

Above the entrance of the famed academy of Plato in Athens, one could read "Μηδείς ἀγεωμέτριτος εἰσήτω" No one without knowledge of geometry will be allowed to enter" - - a hint of the value the classic admirers of reason found in the orderly examination of things. Econometric model building is an exercise in the reasonable and also feasible

relation of things which are interpreted as economic variables. The task of capturing the workings of a complex economy in 15 or 20 relations may be dismissed as a futile undertaking. Yet even though the complete mirror of an economy is not reflected in the model, enough of it is, so as to allow new insights and a better knowledge of not easily recognized relations. It is seldom, if ever, in human development that the entire universe is known. Like the transferring of information, so in the study of economies we concentrate on the important variables and allow the rest to fall into place. The difficulty is not so much with the needed study of very large number of relations in an economy, but instead the detection, specifications, and successful statistical estimation of those relations that are more crucial in explaining the economic system. An econometric study, as the one presented, provides a piece of information about the economy and should be treated as no more than just that.

The quality of such a study centers on the "goodness" of the model presented. The "goodness" of a model is in turn conditioned by the successful incorporation of essential information in the model. More equations or better statistical fits cannot assure a good econometric model. They are only necessary but not sufficient conditions. More equations do not mean proportionately more information for our model, our space may not be additive (as models 36-S and 32-S indicate).

J. Johnston suggests that one look at the following when evaluating an econometric model (63).

(1) R^2 (coefficient of determination)

(2) D-W (Durbin-Watson statistic for autocorrelation)

(3) Forecasting ability.

We may add simplicity as an additional criterion. For model 36-S, as well as the models included in Appendix B, the statistical criteria, R^2, t-test and Durbin-Watson are satisfactory. The maze of available data of dubious quality on the one hand and the lack of definitive guidelines for the choice of the most relevant equations for inclusion in the model, render inadequate any exclusive reliance on statistical criteria in evaluating model quality. The difficulty in selecting the important variables for inclusion in the model is not unusual.

Though economic theory (consumption, production theory, etc.) often provides useful guidelines for the inclusion of the significant variables in a model, it is often a resort to intuition, "just a feeling", that often prompts the form of the maintained hypothesis. As Charles Schotta suggests, "we have no theory of the construction of a theory" (84). Henry Theil, in dealing with the same methodogical problem writes,

> "What is incorrect . . . is to act as if the final hypothesis presented is the first one, whereas in fact it is the result of much experimentation. Since every econometric analysis is an essay in persuasion--just as it is true for any other branch of science, the line of thought leading to the finally accepted result must be expounded. It is not true that analyses which are in the end not accepted are useless." (91, p. 207)

In the final analysis one is forced to judge the quality of an econometric model by its ability to predict over unknown (not included in its estimation) territory. This implies that in the ideal sense, good prediction is inseparable from sound economic specification. Though it is possible to have valid prediction without sound economic specification that prediction will <u>always</u> be correct, since it is understood that sound economic specification is by definition the good description of the real

world. If it were that an econometric construct give sound predictions for all time, then that construct must be correctly specified. Otherwise it is difficult to judge a model on the basis of how well it describes new data over a limited future range. One is not sure if the forecasting error is due to error in specification, a wrong model, or if the structure (coefficients) have changed. We should expect from the assumption of stability in economic relations that the closer we forecast to the mean of the period of the sample, the more the forecasting error will be due to specification error. The 1964 forecasting results of our models appear encouraging in this respect (10, 11). The forecasting result is then the important criterion in judging the quality of an econometric model.

Admittedly the above discussion is not sufficient to clarify a fundamental methodological question in economics (66, Essay No. II, pp. 129-166). One can only state and reason his position. The immensity of statistical problems and data error, however, force faith in the judgement of the quality of a model in the direction of the model's results. The classic methodological question is often expressed in terms of the validity of assumptions vs. the validity of results. If one is to venture a reconciliation of the two, the following can be suggested. If the results are valid <u>for all time</u>, then the assumptions (specification) must be correct. If, on the other hand, the assumptions are valid, then the results must be correct but we cannot fully know the correctness of the results. The difficulty that allows the debate undecided and ends up with faith in the one or the other criterion, is perhaps explained by the "valid for all time" condition. In the operational sense, a result (a

prediction) may be valid at a given time but no assurance can suffice to conclusively show that the validity is not ephemeral. Thus "accidentally" incorrect specification can give valid results. If the results were valid for all time, however, the specification must have been valid also. Other specifications may give the same results but from the operational sense, one is indifferent, ceteris paribus, as to which specification is to be preferred.

Future changes in economic behavior as reflected in changing structure and regimes, will understandably influence the operational usefulness of a model. The ex-ante specification of such changes remains a terra incognita and perhaps an impossible task when considering the astounding complexity of economic relations.

CHAPTER IV. AGRICULTURE

Agriculture in the Cyprus Economy

In this chapter the agricultural sector of the economy is investigated in view of the econometric findings. A number of policy recommendations are made.

Agriculture is by far the most important economic activity of Cyprus. In the last few years the contribution of this sector to the island's gross domestic product has been around 20 percent with approximately 40-43 percent of the labor force employed in this sector. Agricultural products made up 50 percent of merchandise exports in 1963 and 60 percent in 1965. Total agricultural output has been rising. Net value added by agriculture, estimated at 15 mill (1958 prices) in the 1946 census, increased to £ 18 mill in 1958 and £ 24.5 mill in 1963. The growth path of agricultural output in the period 1950-1964 is given in Figure 3. The production of some principle agricultural commodities is shown in Table 9.

The future contribution of agriculture to the island's economic growth will not be limited to direct output and increased agricultural exports. A less apparent contribution will be the release of labor from the agricultural sector for use in manufacturing, government services and trade in order for economic transformation to take place. What happens to agriculture is crucial to the subsequent economic development of Cyprus (54). The economic policy targets, an increase in national output (Y), and a favorable balance of payments equilibrium (B), are directly effected by developments in the agricultural sector. The imports with domestic

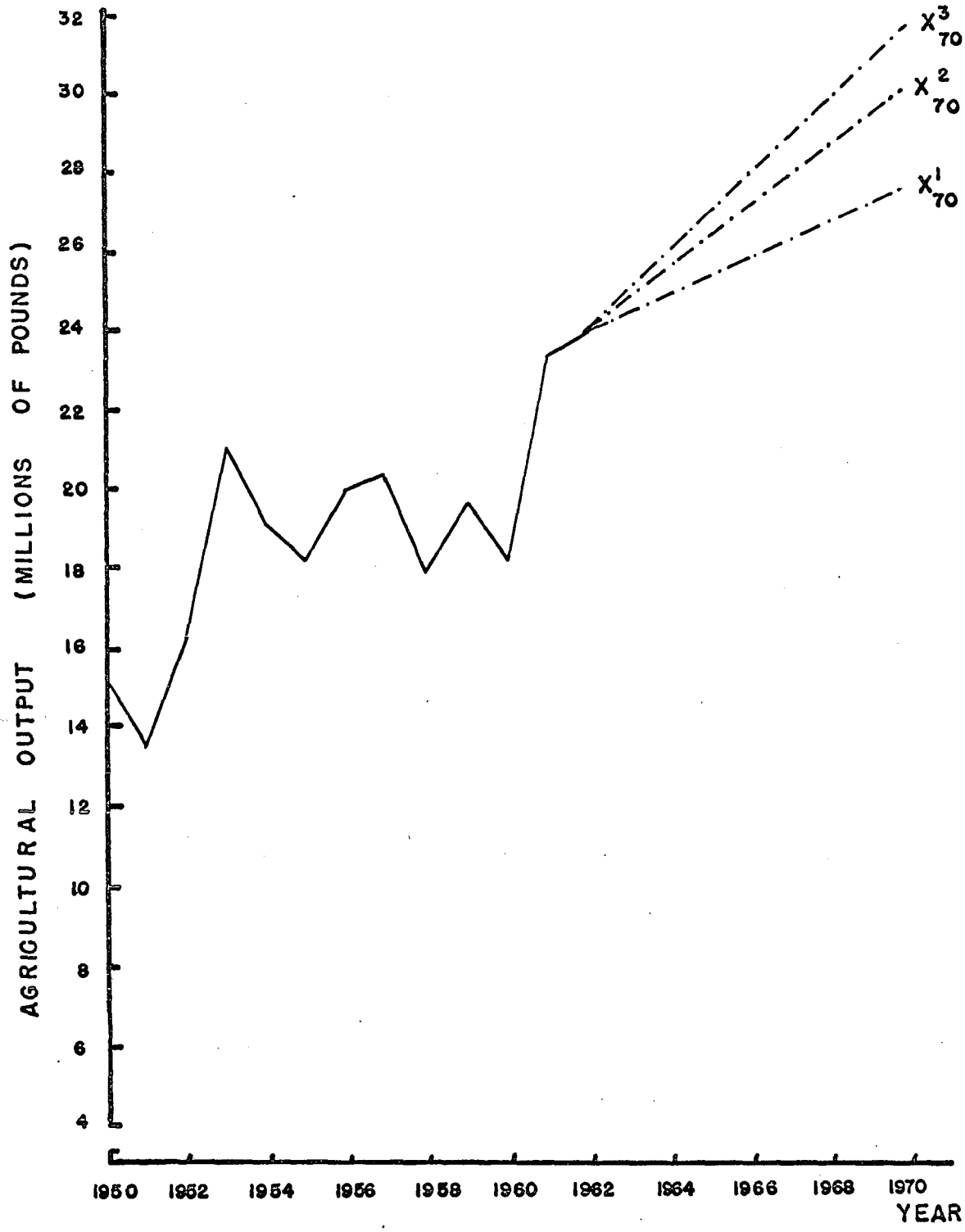

FIG.3 AGRICULTURAL OUTPUT AT CONSTANT PRICES (1958), PROJECTIONS TO 1970

Table 9. Production of principal agricultural products[a]

Products	Units	1959	1960	1961	1962	1963
Wheat	1000 Kile	2,307	1,524	1,714	2,476	2,400
Barley	" Kile	3,040	2,000	2,250	4,500	4,400
Oats	" Kile	133	92	80	123	130
Broadbeans	" Okes[b]	1,704	1,256	1,504	1,600	1,362
Vetches	" Kile	130	142	128	140	183
Haricot beans	" Okes	1,379	1,360	1,200	1,240	724
Vicos	" Kile	107	96	101	134	72
Potatoes	" Okes	64,000	60,000	64,000	92,000	84,000
Tobacco	" Okes	593	585	707	802	750
Grapes	" Okes	103,000	80,000	103,000	100,000	50,000
Olives	" Okes	6,481	5,000	22,000	5,000	9,600
Carobs	" Okes	40,000	36,000	33,600	44,000	56,000
Carrots	" Okes	7,000	9,200	8,000	16,000	25,600
Melons	" Okes	3,200	4,400	5,200	6,400	7,000
Water melons	" Okes	11,000	10,000	9,500	8,000	8,000
Oranges	" Cases	1,042	1,239	1,700	1,280	1,900
Lemons	" Cases	336	241	432	430	450
Grapefruit	" Cases	246	305	340	350	370
Apples	" Okes	1,030	1,080	1,120	1,480	1,500
Almonds in shell	" Okes	1,637	2,080	1,920	2,000	2,050

[a]Source: (17, p. 38).

[b]Note: 1 Oke = 2.8 lbs = 1.27 Klgs.

Table 9. (Continued)

Products	Units	1959	1960	1961	1962	1963
Eggs	1000 Doz.	--[c]	4,600	5,000	5,500	5,700
Poultry meat	Tons	--	2,000	2,300	2,500	2,700
Sheep and goat meat	Tons	--	3,800	4,000	4,000	4,000
Beef and veal	Tons	--	2,000	2,200	2,300	2,500
Pork	Tons	--	1,400	1,800	2,000	2,500
Milk (Sheep, Goat & Dairy Cattle)	Tons	--	28,200	30,200	31,500	33,200
Wool	Tons	--	450	500	500	550

[c]-- = Not available.

substitutes equation of model 36-S, (#11: $MDs = -7.798 - 0.405\ Y_A + 0.218Y$) shows a significant import substitution effect of Y_A, domestic agricultural production, on imports with domestic substitutes, MDs.* (Mainly foodstuffs, furniture, beverages, tobacco.)

The agricultural production function of the model is of the Cobb-Douglas type.** Conventional inputs, rainfall and raw materials, mainly chemical fertilizers, are successfully incorporated in the estimated

*At the 10 percent level of significance. A similar significance of domestic food production to import substitution, is found by the Klein-Shinkai Econometric model of Japan. See International economic review, Vol. 4, No. 1, February 1963, pp. 1-28. In Cyprus, cereal production is the most significant crop entering as an import substitute.

**A non-logarithimic function is also employed.

function. It is understood that the break from traditional agriculture has taken place in Cyprus and thus a number of significant non-economic prerequisites have been met. The break from subsistence agriculture can be evaluated in terms of the inputs used in production. For example, the use of chemical fertilizers, first introduced to Cyprus as far back as 1911, has trebled since 1950. A total of 29.4 thousand tons of fertilizers, disinfectants, insecticides and sulfur (variable RA in the model) were imported in 1950. This variable reached 105.0 thousand tons in 1963. The number of tractors increased from 120 in 1946 to 4,696 (including combines) in 1963. Mechanically irrigated land increased from 53,131 donums* in 1946 to 210,000 donums in 1963. See Table 10 Land under irrigation.

The transition from stagnant traditional agriculture to its present dynamic developing stage is of interest to the analyst. Improvements in agriculture were initiated early in the British administration.** Change has been gradual, however, and has extended over many years. Peasant subsistence agriculture and its outmoded practices during the early years of the British rule are graphically described by Diamond Jennes (61, p. 149). ". . . the peasants still stolidly followed the methods their ancestors had employed in the days of the Pharohs, using antiquated tools at the cost of backbreaking labor for both man and animal." The escape from stagnant traditional agriculture to its present rather hopeful stage was not an easy task. Jennes continues, ". . . tradition-bound to the point

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*3.025 donums = 1 acre.

**The British took administrative control of Cyprus from Turkey in 1878. Britain unilaterally annexed Cyprus in 1914. Turkey accepted this annexation with the Treaty of Laussane in 1923.

Table 10. Land under irrigation[a]

	Gravity Irrigation		Mechanical Irrigation (i.e. Pumped)	Total
	Perennial Donums	Seasonal Donums	Donums	Donums
1946 Census	59,409	284,977	53,131	397,517
End of 1955	86,500	345,000	113,500	545,000
" 1956	88,500	354,000	123,000	565,500
" 1957	89,000	358,500	138,500	586,000
" 1958	89,000	359,500	149,000	597,500
" 1959	91,000	361,000	162,500	614,500
" 1960	91,000	361,000	180,000	632,000
" 1961	96,500	369,500	190,000	656,000
" 1962	102,800	377,000	200,000	679,800
" 1963	111,700	405,100	210,000	726,800
" 1964	113,900	428,100	210,200	752,200

[a]Source: (17, p. 37).

of inertia, like most primitive agricultural communities, they (the Cypriots) manifested scant desire to change their ways in conformity with the advice of their new rulers (the British)." (61)

With adequate demonstration, and thanks to the laborious efforts of the first director of the Department of Agriculture, Dr. P. Gennadius, the farmers' skepticism and inertia gave way to experimentation and improvement using new technology. These early improvements had an enormous

effect on Cyprus agriculture. The work done during the first half of the century fulfilled some major institutional prerequisites for agricultural development to the extent that conventional factor inputs are now significantly effecting agricultural production. The agricultural production function of the model, estimated over the period 1951-1963, shows fertilizer as a significant input with an elasticity of production (E_{RA}) of 0.37. A number of major structural reforms are still essential for the upward shifting of the production function, the most important of which is consolidation of the badly fragmented agricultural land.

The rapidly increased demand for fertilizer is the consequence of the farmer's realization that it is an input with considerable net productivity. A similar pattern of almost continuously expanding fertilizer demand has been observed in United States agriculture during the 1933-1955 period. The main force underlying this increase, apart from the realized higher productivity, are given by Heady, as (a) the favorable price of fertilizer relative to crop prices, (b) increased knowledge, (c) improved managerial skills, and (d) income positions of farmers (57, pp. 154-193). These same factors that affected the increased use of fertilizer in American agriculture are currently working in Cyprus agriculture. In addition, it should be noted that land overworked since antiquity with seriously eroded topsoil, is typical of Cyprus, so that the long run productivity of fertilizer inputs should be expected to be higher, ceteris paribus, than in United States agriculture where in general the land is rich with other nutrients.

Let us now turn to the policy implications of our econometric findings in regard to the aggregate agricultural production function. The

importance of agricultural production to national output and merchandise exports has already been pointed out. Cyprus remains an agricultural country with a relatively low per capita income.* Increase in total output remains a major economic objective. At the same time, the island suffers from a serious merchandise trade deficit. Merchandise imports were more than double the merchandise exports. The merchandise trade deficit is covered by invisibles, mainly the inflow of foreign exchange from the two military bases on the island. The great dependence of the economy on exogenous factors, such as the income from the British bases, signifies fundamental structural weaknesses in the economy. The rather high standard of living appears deceptive when taking a closer look at the structure of the economy. A sudden decision on the part of the British government to eliminate or greatly reduce military expenditures in Cyprus would have disastrous repercussions on the economy and living standards.

This is very likely to occur under the British economic austerity program and the military economies undertaken by the Wilson administration. For more discussion on the effects of a major reduction in British military expenditures on the Cyprus economy, see page 138. The capacity of the economy to import investment goods and raw materials would be seriously impaired. Input-output studies of the economy reveal a minimal degree of intersectoral linkage (76). Buying and selling between domestic sectors appears marginal and unimportant.

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*Per capita income $\left(\frac{\text{GNP}}{\text{Population}}\right)$ in 1963 was approximately $590. The figure dropped to $575 in 1964 due to the adverse political situation.

Econometric Findings and Policy Implications

With agriculture such an important economic activity to the future of the economy, the following can be inferred from the estimated agricultural production function. Rainfall (RF_{-1}) and raw material inputs (RA) are significant at the 5 percent level. Jointly the inputs explain 71 percent of agricultural output. The significance of rainfall is not surprising. Rainfall is a scarce resource in Cyprus. According to the Willard L. Thorp report, Cyprus must be considered a semi-arid country (95, p. 6). The RF index over the 14 year period considered for our estimation averaged 18.2 inches and fluctuated between 13.38 inches in 1951 to 24.00 inches in 1955. At this range of rainfall, the production response is shown to be very significant. The elasticity of production with respect to RF_{-1} was estimated at 0.38. The government, following the Thorp report recommendations, is pursuing a rather successful investment policy in water resource development. Water development expenditure by government was close to 25 percent of total government expenditures for development in recent years. Conservation of rainfall progressed rapidly through the construction of dams and the enrichment of underground basins.* The beneficial results of water policy, however, are of a long run nature. Rainfall remains a strictly exogenous variable and outside the control of the policy makers. The short run policy emphasis should then be on raw material inputs and the general availability of such inputs to the farmer. This recommendation is

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*In spite of the recent hopeful developments in agriculture the economy is only about 60 percent self-sufficient in stable foods. The main deficiencies are in (1) dairy products (2) meats (3) fats and oil (4) sugar, and (5) grain (in years of draught).

supported by another finding of our analysis. The dummy variable analysis given on page 75 indicates that the elasticity of production with respect to RA (E_{RA-58}) is 0.28 during the 1951-1958 period. This same elasticity rose to 0.82 in the 1958-1963 period. An indication that diminishing returns with respect to RA has not been reached in agriculture.

The preferred agricultural production function discussed in this chapter from the economic and statistical point of view, is of the Cobb-Douglas type. A number of maintained hypotheses were attempted. Last year's rainfall (RF_{-1}), measured as an index of yearly precipitation and the yearly imports of agricultural raw materials in thousands of tons (RA), proved the most significant and "reasonable" explanatory variables of total agricultural production.* Table 53 in Appendix D gives a number of attempted functions.

The preferred function is

$$Y_A = 1.459\ RA^{.37}\ RF_{-1}^{.38}$$

The above function performed best when compared with two other estimated functions including the same explanatory variables (RA, RF_{-1}). Table 11 gives the three equations and the observed values of explanatory dependent variables.

Y_{A1} is estimated over the 1950-1963 period with the years 1960 to 1963 included twice in the sample space on the assumption that these are years with marked change in structure (the end of the colonial period) and also

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*For methods of calculation, definitions of variables and data information, see Appendix C. Variable RA includes chemical fertilizers, disinfectants, insecticides and sulfur. Fertilizer makes up more than 95 percent of RA.

Table 11. Comparison of agricultural production equations

					RES	R^2	F	U
1.	Y_{A1}	$= 6.500 + 0.121\ RA + 0.311\ \overline{RF}_{-1}$			14	.73	19.03	.0172
	t	2.291	6.036	2.581				
2.	Y_{A2}	$= 6.340 + 0.117\ RA + 0.331\ \overline{RF}_{-1}$			11	.75	12.13	.0104
	t	2.149	5.539	2.507				
3.	$Log_{10}Y_{A3}$	$= 0.164 + 0.370\ Log_{10}RA + 0.377\ Log_{10}\overline{RF}_{-1}$			10	.71	12.13	.0069
	t	0.634	4.805	2.660				

DATA

Variable	1959		1960		1963		1964	
	F[a]	A	F	A	F	A	F	A
Y_{A1}	20.538	19.7	19.637	18.2	25.269	24.5	21.811	23.3
Y_{A2}	20.375	19.7	19.474	18.2	25.079	24.5	21.648	23.3
Y_{A3}	20.305	19.7	19.310	18.2	25.009	24.5	21.662	23.3
RA		76.9		72.0		105.0		83.90
RF_{-1}		15.22		14.23		19.50		16.59
$Log_{10}RA$		1.8859		1.8573		2.0212		1.9238
$Log_{10}RF_{-1}$		1.1824		1.1532		1.2900		1.2199

[a] F = forecasted, A = actual.

of better statistical data. Y_{A2} is estimated over the 1951-1963 period and Y_{A3} is in Log_{10} form of the Cobb-Douglas type. The forecasting performance of the three equations is tested by the use of the formula

$$U = \frac{\sqrt{\frac{1}{n}\sum(F_i - A_i)^2}}{\sqrt{\frac{1}{n}\sum(F_i)^2} + \sqrt{\frac{1}{n}\sum(A_i)^2}}$$

The Cobb-Douglas form gives the smallest U and does better in all four years of forecasting. Equipment in the form of agricultural machinery, gross capital formation in agriculture, price levels, labor and other "reasonable" explanatory variables were not successfully incorporated in the production function.

The significance of rainfall cannot be overstated in the case of Cyprus agriculture. An increase of rainfall by 10 percent, that is, 1.8 inches, brings on the average a 3.7 percent increase in agricultural output the following year. The analysis shows a year's rainfall to be very significant on the subsequent year's production. This implies that the late fall, early winter rainfall through December is very significant for agricultural output. Regression of the non-lagged RF on Y_A showed RF not to be significant. It appears that the rainfall up to and including December (usually 40-50 percent of total seasonal rainfall), is more significant than late winter and spring rainfall. A plausible explanation of this phenomenon is the practice of Cypriot farmers to plant, especially cereals, "dry". That is, to plant during the fall in anticipation of early rainfall. If the farmers expectations for early rainfall are fulfilled, the results are good with yields high. If not, rainfall is low,

the early sowing effort is wasted and a negligible or no yield is realized. No figures were available on the quantitative share of "dry" sowing. Individuals familiar with Cyprus farming practices estimate "dry" sowing to be as much as 45-50 percent of cereal production.

It is also to be noted that regression analysis based on yearly time series data, is more suitable in showing, as significant variables, those that change from year to year with corresponding responses from the dependent variable. Thus, variable and not fixed inputs are best incorporated in the analysis. Mechanically irrigated land did not enter the function significantly though, on a priori grounds, it is seen to be an important variable. Large indivisibilities in production are not incorporated in the function.

An attempt to incorporate time as an explanatory variable ("other" inputs) was not successful. The time elasticity was insignificant and the "other" variables failed to enter the function. It proved more successful to show the growing importance of the fertilizer input. In order to see if the marginal productivity in relation to RA has changed over time, we used the following dummy variable analysis (62, p. 223).

$$\text{Log } Y_A = r_1 + r_2 \log X_2 + b_1 \log RA + b_2 \log Z$$

where $Z = X_2 RA$

and $$X_2 = \begin{cases} 0 \text{ in } 1951\text{-}1958 \\ 1 \text{ in } 1958\text{-}1963 \end{cases}$$

The 1951-1958 function was estimated as $Y_A = 6.34\ RA^{0.28}$

The 1958-1963 function was $Y_A = -3.80\ RA^{0.82}$

The above results show a marked increase in the elasticity of production with regard to RA (from .28 to .82) which implies that diminishing returns in agriculture in relation to RA have not been reached as yet.

Another interesting phenomenon is observed. The RA and RF_{-1} are negatively correlated for the period 1950-1963. Every year of increased rainfall is followed by a year of increased RA. This phenomenon is observed in thirteen out of the fourteen years covered by the time series. It is a strong indication that the Cyprus farmer attempts to make up low rainfall by applying more fertilizer. A 10 percent increase in fertilizer, a 6.3 thousand ton increase at the mean, increases Y_A by 3.7 or .73 mill pounds at 1958 prices. Roughly, at an extra cost of 6,300 tons X £45 = £283,000, the additional returns are £ 730,000. Though this figure appears high it is not unrealistic in view of the North Carolina study given in Table 12. If the production function is at the increasing returns range in relation to the fertilizer input (as the analysis on page 75 indicates), a 150 pounds of fertilizer gives a marginal physical product of 9.40 bushels of wheat. This is approximately 560 pounds or .28 tons. A ton of wheat would sell at approximately £ 35, 1958 prices in Cyprus, so that 150 pounds of fertilizer or .075 tons cost .075 x 45 = £ 3.4. This input gives an output worth .28 x 35 = £ 9.8 and $\frac{9.8}{3.4} = 2.9$. The same output-input ratio estimated from the aggregate production function is $\frac{730}{283} = 2.6$, a very close correspondence when considering that the individual farm productivities deal only with wheat and with one kind of fertilizer input. The comparison is here given as a test of feasibility of the results, not as a verification. It is to be noted, in addition, that in

Table 12. Mixed fertilizer (4-9-2) marginal physical productivity for wheat in North Carolina based on a study made over a 15-year period, gave the following results[a]

Fertilizer applied (pounds)	Wheat TPP	MPP (bushels)
None	2.75	--
150	12.15	9.40
300	18.05	5.70
450	22.65	4.60
600	24.25	1.60

[a]As given in (70, p. 70).

the Klein-Shinkai econometric model of Japan (65) the elasticity of the fertilizer input to agricultural production is estimated at 0.322.

The factor substitution ratio $\frac{d(RA)}{d(RF_{-1})}$ is found below to be equal to 3.56 at the means. That is, in order to maintain the same output during the period, a decline of RF_{-1} by one inch must be made up by an increase of 3.56 thousand tons in RA.*

*Rates of substitution.

(1) $Y = X^a Z^b$

(2) $dY = 0 = a\, X^{a-1} Z^b dX + b\, X^a Z^{b-1} dZ$

(3) $-\frac{dY}{dZ} = \frac{b\, X^a Z^{b-1}}{a\, X^{a-1} Z^b} = \frac{bX}{aZ}$

(4) $-\frac{dX}{dZ} = \frac{b}{a}\ \frac{X}{Z}$

(5) $\frac{d(RA)}{d(RF_{-1})} = \frac{.38 \times 62.9}{.37 \times 18.16} = 3.56$

No information at the Cyprus farm level on fertilizer productivity was available to the writer, but such studies in the U. S. show dramatic yield responses to fertilization. A U. S. D. A. study on the subject showed that in the Southern States region (where yields are comparable to Cyprus) additional fertilization could have increased wheat yield per acre to 32 bushels amounting to 320 percent increase over prevailing yields (100). The full benefits of material inputs would soon encounter diminishing returns, however, unless the production function is shifted upwards. Such a shift requires important educational and institutional improvements.

The importance of agriculture to the island's future calls for a broad and effective government policy. Agricultural research for the adoption of practices already found successful in agriculturally advanced countries as well as general agricultural education are essential if the overall social and economic objectives of the country are to be realized and the benefits of technological progress successfully introduced into the sector. The non-market (externalities) aspects of services such as education and research contributed greatly to the agricultural development of, for example, a country such as the United States, much more than is often realized (55). In addition to educational and technological improvements, a basic structural change in terms of land consolidation must remain an objective of agricultural policy. In all, the potential of Cyprus agriculture remains considerable and much can be accomplished in the immediate future with the adaptation of new techniques and the use of more raw material inputs.

Land Fragmentation

As pointed out earlier, the Cyprus farmer has finally overcome traditional peasant inertia and with the incentives of a market economy, has responded well to new techniques. Land fragmentation, however, remains a major obstacle to higher productivity before larger farm units compatible with greater capital investment and scale economies can be realized. A recent study of fragmentation in Greece reveals a sizable cost to farming due to fragmentation (92). The structure of Greek agriculture, and the forces which led and still sustain land fragmentation, are very similar to those in Greece. The 1960 census for Cyprus gives the average size of farm holdings as 46.6 donums and 9.5 plots per farm. Similar figures for Greece give the average farm size as 59.9 stremmata and 9.2 plots per farm.*

Thompson points out that in the eleven villages sampled, the average all farm distance between holdings per farm averaged nearly 40 kilometers (92). He suggests that waste due to travel alone between holdings amounts to three weeks per year when given that most farmers in mountainous regions travel on foot or by donkey. These findings appear applicable to Cyprus fragmentation and its effects on agricultural productivity.

Land consolidation, regardless of its desirability, is not easy to implement. When it succeeds, as in France and West Germany, it appears more the result of general structural change in the economy rather than of deliberate public policy. If land consolidation is difficult to implement,

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*1 Stremma = 0.25 acre
1 donum = 0.33 acre

Table 13. Fragmentation of holdings by size of holding: 1960[a]

Size of holding	Total			Average No. of pieces and area per holding	
	No. of holdings	No. of pieces	Area (donums)	No. of pieces	Area (donums)
Under 1 donum	911	1,171	437	1.3	0.5
1 - 2 "	1,736	3,023	2,190	1.7	1.3
2 - 5 "	5,471	13,926	17,548	2.5	3.2
5 - 10 "	8,025	31,147	56,602	3.9	7.1
10 - 20 "	12,356	73,536	177,517	6.0	14.4
20 - 40 "	15,410	133,490	440,637	8.7	28.6
40 - 60 "	9,072	108,542	442,050	12.0	48.7
60 - 80 "	5,571	81,267	382,870	14.6	68.7
80 - 100 "	3,538	58,580	314,079	16.6	88.8
100 - 200 "	5,706	112,482	763,203	19.7	133.8
200 - 500 "	1,448	37,943	404,841	26.2	279.6
500 -1000 "	138	4,288	90,867	31.1	658.5
1000 & over	63	1,493	140,155	23.7	2,224.7
Total	69,445	660,888	3,232,996	9.5	46.6

[a]See (15, vol. 6, p. 9).

perhaps an intermediate scheme can be worked out. Cooperatives, most developed enterprise in rural Cyprus, can play a role. In this respect, it is unfortunate that the direction taken by agricultural cooperatives in the island is one of consumption rather than of production. Whatever the means of implementation, it is essential to the future of Cyprus agriculture that land consolidation proceed at a rapid pace.

Agriculture and Structural Change

Agricultural development, though the cornerstone of economic development for Cyprus, is not in itself sufficient for development. Furthermore, agricultural development is closely linked to the development of other sectors.

The high share of agriculture to total output and the low productivity of the sector, especially in mountainous area, do not prevent Cyprus agriculture from being of the market type where prices approximate relative scarcities and productivity conditions. Agricultural labor, though of low productivity as judged by the agricultural per capita income, is not redundant, and total output in this sector will decline if, under present productivity conditions, labor was removed from the farm. The non-redundancy of agricultural labor is indicated by rising real wages in this sector. See Table 14. Seasonal fluctuations render agricultural labor a scarce factor at times. Such seasonal scarcity prompted the employment of the National Guard in the picking of potatoes in 1965.

If one were to place Cyprus agriculture in one of the customary stages of agricultural development, it should be between the stage where the

Table 14. Index of real wages[a]

	1958	1959	1960	1961	1962	1963
All Activities	135.5	133.7	137.4	145.1	148.1	152.5
Agriculture	148.0	147.5	144.4	158.1	158.8	160.4
Mining	141.8	139.5	145.6	158.0	167.1	171.7
Food industries	134.6	128.4	127.2	140.0	134.8	134.7
Building and construction	124.6	119.6	135.2	143.8	146.9	160.7
Other activities	130.2	129.5	131.4	131.2	135.6	132.9

[a]Source: (17, p. 36).

marginal physical product of labor is positive and increases as additional workers leave the farm, and the final state of full commercialization when no underemployment is to be found and labor productivity is comparable with the non-agricultural sector (94).

Under these circumstances and the relatively good labor mobility, it is difficult to pursue a development policy of the Lewis type where redundant labor is to be mobilized for development without any perceptible decline in agricultural output (74). The marginal productivity of labor in agriculture, though low, is significant enough. The withdrawal of labor under present technology will adversely effect agricultural output. Under such conditions, high agricultural productivity becomes necessary for the release of labor from the agricultural sector. Labor released from agriculture must find employment elsewhere if severe unemployment and urbanization problems are to be avoided. In this respect the large waves of emmigration characteristic of Cyprus provide an unemployment stabilizer

as well as generous transferred income from abroad. Within the goal of long run economic development, however, emmigration is a major loss to the economy which ultimately must depend on her human resource for a successful and lasting development. The continuous release of labor from agriculture puts great weight on the development of alternative employment opportunities. It is for this reason that manufacturing development, within the very binding constraints of a small economy, remains essential.

Higher agricultural productivity together with the low income elasticity of demand for food commodities releases labor from the farm at high rates causing serious unemployment problems in the cities. Labor mobility allows urbanization to proceed rapidly so that instead of the characteristic rural underemployment, in itself not an explosive social issue in the traditional society, urbanization causes explosive unemployment situations with wages forced below the margin of subsistence which had previously been maintained by the extended family.

The trend toward urbanization is expected to continue under economic development. Next to economic growth, the balance of payments problem and Greek-Turkish relations, rapid urbanization will pose the most serious socioeconomic problem of the island. Efforts could be made for the operation of alternative employment opportunities in rural areas similar to the decentralization of manufacturing industries attempted in a number of larger countries. This is not an easy task, however, as the U. S. experience showed (82).

The increase in agricultural exports may allow a large share of the population to be permanently employed in the agricultural sector even

under increasing agricultural productivity, but the present level of 40-45 percent of the economically active population employed in agriculture, is too high and must be expected to decline to 25 - 30 percent in the near future. Projecting population of the basis of the 1950 decade rate of growth (1.36%), the Cyprus population should reach approximately 650 thousands (at 2 percent growth rate - 682 thousands) by 1970. If the 1960-1963 average ratio of economically active population to total population (41 - 41.3 percent) is maintained, the 1970 economically active population can be estimated to be approximately 270 thousand. Assuming agriculture will productively employ 35 percent of the economically active population in 1970, agriculture must then employ, under our assumption, 94.5 thousands, and the other sectors 175.5 thousand. This means that close to 30-35 thousand new jobs must be created in the non-agricultural sector by 1970 as compared to the average employment levels of the 1961-1963 period. We now turn to manufacturing, the sector most likely to absorb the labor released from agriculture and also a sector most conducive to high labor productivity because of its capital intensive nature.*

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*The importance of manufacturing to the economic development of Cyprus is well realized by the island's policy makers. (See (89). Though government policy encourages industrial development through tax incentives, especially of foreign capital and a number of joint ventures in cooperation with private interests (i.e., Cyprus oil refinery), the development of this sector is left to private enterprise as the very low appropriations to commerce and industry in the development budget show.

CHAPTER V. MANUFACTURING

The Low Share of Manufacturing Output

Hollis Chenery, in his cross-sectional studies of industrial growth, showed that in countries with levels of income comparable to Cyprus, manufacturing should amount to 20-25 percent of the national product. The same study showed that an increase in per capita income is normally accompanied by a rise in the share of industrial output (9). Manufacturing in Cyprus, however, in recent years (1960-63) contributed on the average 12.7 percent of the national product. Thus the share of manufacturing in the national product of Cyprus is significantly lower than what the Chenery findings call for. The policy maker may be tempted to recommend a massive increase in manufacturing to bridge the gap between actual and "normal". However, Cyprus can, with reason, be viewed to differ from the trend. Before any recommendations can be made, the following can be said on the low share of manufacturing in the Cyprus economy.

According to Chenery, there are three causes of nonproportional growth in domestic manufacturing output (increased percentage share in total output with rising per capita income). These are:

a. import substitution

b. growth in final demand

c. growth in intermediate demand, derived from growth of final demand

Import substitution is found to account for more than 50 percent of industrialization brought about by rising income. While changes in the composition of final demand prompt the nonproportional growth of sectorial outputs, it is the comparative cost structure in the developing country

as compared with cost structures abroad that decides the source of supply. The fundamental relationship underlying items a and c above, is the comparative cost structure. Cyprus, when under the British, was in customs union with the "mother" country. As such, the island was expected to sell primary products in exchange for industrial imports. Thus, import substitution did not develop to its "normal" level. If in the past the colonial status of the island was the only cause of the low share of manufacturing in total output, one could expect that with the eclipse of the colonial era, present conditions would soon correct the deviation.

Economies of Scale and Manufacturing Development

A most fundamental factor for the low share of manufacturing in the Cyprus economy and one with important future policy implications for the island's economic future remains the unusually small size of the Cyprus market. Rising incomes will enlarge effective demand, but the small size of the population, 150,000 households at present, will constitute a permanent constraint to the increased share of manufacturing output. A major part of the changing composition in demand has been satisfied with more manufactured imports, with domestic industry playing only a minor role. An attempt to incorporate domestic manufacturing in the imports with domestic substitutes equation (Equation 11, Model 36-S) failed; domestic manufacturing did not prove significant. It may be added, on the other hand, that agricultural output entered the equation as a significant import substitute. The very small market size does not allow for large enough manufacturing firms to exploit scale economies, so the cost structure in most manufacturing remains unfavorable to domestic Cyprus production. The

1962 census of industrial production (16) (following the United Nations international standard industrial classification procedure) reports that 60.6 percent of industrial establishments in Cyprus employed one person or less. Only 0.2 percent employed over 100 persons, an indication of the dual character of the industrial sector at this stage of its development. (Table 15) Food manufacturing, the beverage industry, footwear and wearing apparel constitute the most important manufacturing activities.

Table 15. Percentage distribution of establishments and employment by size of industry and locality, 1962[a]

Size	Establishments			Employment		
	Whole Cyprus	Urban	Rural	Whole Cyprus	Urban	Rural
All sizes	100.0	30.0	70.0	100.0	51.2	48.8
1	60.6	9.8	50.8	20.0	3.2	16.8
2-4	31.6	14.3	17.3	26.9	12.9	14.0
5-9	4.8	3.5	1.3	9.8	7.3	2.5
10-49	2.5	2.0	0.5	15.6	12.6	3.0
50-99	0.3	0.3	-	5.8	5.7	0.1
100 & over	0.2	0.1	0.1	21.9	9.5	12.4

[a]Source: (16).

Bain's quantitative estimation of cost schedules for United States industrial plants reveals the cost curve of a large number of industries to be horizontal over considerable range (3a). The same study shows that the efficiency level of output per plant is at a sizable percentage level of

the United States market. This market even when considered in its smaller submarkets is very large compared to the domestic market of Cyprus.

Assuming low income elasticities for some products, similar total expenditure per capita in both countries and the same potential technology in similar industries, it can be suggested that the Cyprus market can sustain efficient plants whenever for the same good, an efficient plant in the U. S. is of a size covering .004 - .006 of the U. S. market.* For example, flour milling plants can reach minimum engineering scale economies according to the Bain study, at a size of 1/10 of one percent of the United States national market as of 1951. An efficient flour plant can then be sustained for every 160 thousand people. Given the Cyprus population of 600 thousand, three to four flour milling plants can be sustained at optimum scale efficiency. The Cyprus industrial census gives two establishments in grain mill products employing twenty or more employees in 1962.

One hundred and twenty establishments employing one person are also given in this category. A similar comparison of cement plants shows that only one plant can be sustained and only at 15 percent higher cost than the lowest attainable under United States efficiency standards.** The 15 percent higher per unit cost can easily be covered by savings in transportation, estimated at 12 to 25 percent of original cost for Cyprus. One cement plant is now operating in Cyprus. The possibility of exports, due

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*U. S. 1950 population of 150 million x .004 = 600 thousand, the present Cyprus population.

**150 x .005 = 750 thousand per plant.

Table 16. Percentage distribution of establishments, of total persons engaged and of employees, classified by industry, 1954 and 1962[a]

Industry	No. of establishments		Average number of employees	
	1954	1962	1954	1962
	%	%	%	%
MINING AND QUARRYING	100.0	100.0	100.0	100.0
Metal mining except iron ore mining	1.1[b]	2.7	65.3	77.5
Crude petroleum & natural gas	0.3	-	0.1	-
Stone quarrying, clay & sand pits	76.3	72.6	5.1	4.3
Non-metallic mining & quarrying, n.e.s.	22.3	24.7	29.5	18.2
MANUFACTURING	100.0	100.0	100.0	100.0
Food manufacturing, except beverage industries	11.4	9.8	14.3	12.7
Preparation & preserving of meat	0.5	0.5	0.2	0.3
Manufacture of dairy products	0.9	0.9	1.5	1.4
Canning & preserving of fruits & vegetables	0.1	0.1	0.5	0.9
Manufacture of grain mill products	2.4	1.8	1.5	1.0
Manufacture of bakery products	3.4	3.2	2.9	2.3
Manufacture of cocoa, chocolate & sugar confectionery	0.4	0.6	2.1	1.1
Manufacture of miscellaneous food preparations	3.7	2.7	5.6	5.7
Beverage industries	2.3	0.6	7.6	7.9

[a]Source: (16, pp. 13-14).

[b]Enterprises.

Table 16. (Continued)

Industry	No. of establishments		Average number of employees	
	1954	1962	1954	1962
	%	%	%	%
MANUFACTURING (cont'd)	100.0	100.0	100.0	100.0
Distilling, rectifying and blending of spirits, incl. wines and beer	2.1	0.4	4.9	4.7
Soft drinks & carbonated water industries	0.2	0.2	2.7	3.2
Tobacco manufactures	0.1	0.1	2.7	2.4
Manufacture of textiles	0.2	0.8	3.3	0.8
Manufacture of footwear, other wearing apparel and made-up textile goods	58.9	56.8	30.4	24.1
Manufacture & repair of footwear	15.3	10.6	9.9	6.8
Manufacture of wearing apparel, except footwear	22.4	23.7	20.0	17.1
Manufacture of made-up textile goods, except wearing apparel	21.2	22.5	0.5	0.2
Manufacture of wood and cork, except manufacture of furniture[c]	0.9	5.5	2.2	2.8
Manufacture of furniture and fixtures	6.4	6.0	6.7	6.6
Manufacture paper & paper products	-	0.1	0.1	1.1
Printing, publishing and allied industries	0.7	0.8	4.8	4.2
Manufacture of leather & leather products, except footwear	0.2	0.5	0.4	1.0

[c]Cane containers and cane small ware were included in group 25 in 1962, while in 1954 they were included in group 39.

Table 16. (Continued)

Industry	No. of establishments		Average number of employees	
	1954	1962	1954	1962
	%	%	%	%
MANUFACTURING (cont'd)	100.0	100.0	100.0	100.0
Tanneries & leather finishing plants	0.1	0.1	0.3	0.2
Manufacture of leather products, except footwear & other wearing apparel	0.1	0.4	0.1	0.8
Manufacture of rubber products	0.2	0.4	0.2	0.6
Manufacture of chemicals & chemical products	0.4	0.6	1.4	1.2
Manufacture of non-metallic mineral products, except products of petroleum & coal	2.7	2.8	7.9	7.8
Manufacture of structural clay product	1.4	1.0	4.6	5.3
Manufacture of glass & glass products, & of pottery, china and earthenware	0.9	0.9	0.2	0.3
Manufacture of non-metallic products, n.e.s.	0.4	0.9	3.1	2.2
Manufacture of metal products, except machinery & transport equipment	4.3	5.5	3.6	6.3
Manufacture of machinery, except electrical machinery	1.0	1.4	2.7	5.4
Manufacture of electrical machinery, apparatus & supplies	0.4	0.6	0.5	0.6
Manufacture of transport equipment	3.7	5.6	7.2	12.8
Slip building & repairing	0.1	0.1	0.3	0.1
Repair of motor vehicles	1.6	3.8	5.5	12.0
Manufacture of bicycles (incl. repairs)	1.5	1.4	0.7	

Table 16. (Continued)

Industry	No. of establishments		Average number of employees	
	1954	1962	1954	1962
	%	%	%	%
MANUFACTURING (cont'd)	100.0	100.0	100.0	100.0
Manufacture of transport equipment, n.e.s.	0.5	0.2	0.7	0.2
Miscellaneous manufacturing industries	6.2	2.3	4.0	1.7
Repair of watches & clocks	0.3	0.6	0.1	0.1
Manufacture of jewellery and related articles	0.6	0.9	0.3	0.7
Manufacture of musical instruments	-	-	-	-
Manufacturing industries, n.e.s.[c]	5.3	0.8	3.6	0.9
ELECTRICITY, GAS, WATER AND SANITARY SERVICES	100.0	100.0	100.0	100.0
Electricity, gas & steam	66.7	57.1	87.2	87.8
Electricity light & power	61.1	42.9	87.2	85.5
Gas manufacture & distribution	5.6	14.2		2.3
Water supply	33.3	42.9	12.8	12.2

to the availability of raw material on the island, might make feasible the establishment of a second such plant.

A more recent study by Bain on international comparisons of manufacturing size, covering eight countries, shows that average size varies considerably among nations (36, p. 24-66). For example, in the canning and fruit-vegetable preserving industry, Sweden has an average number of employees in the 20 largest firms which places it on an index of 8 when compared to the United States' index of 100. Size is here equated with the number of employees and thus no account is taken for variations in labor productivity among countries. The very large disparity of labor force size, in apparently efficient plants shown by the Bain study, must be interpreted as an indication of the horizontal nature of average costs over a large range of output. Scale economy limitations, however, remain an ultimate technological constraint with serious policy implications on the industrial development of a small country such as Cyprus.

For a large number of industries, scale economy considerations alone will prevent their efficient operation. But all is not dim for a small economy. For a considerable number of industries, plant size can be efficient at relatively low levels of output, shoes, canned fruits and vegetables, fresh meat packing and metal containers, and fresh baked goods are some such industries. A large number of small industries is feasible under modern economy standards. For the domestic market and import substitution purposes, the advantage of minimum transportation costs in domestic production will allow competitive cost structures at levels above the minimum engineering requirements. Table 17 gives over a hundred small industries

Table 17. Selected United States small plant industries,[a] 1958[b]

Industry title	Number of small plants	% of industry value added in small plants
Creamery butter	1,033	77
Natural cheese	1,192	79
Condensed and evaporated milk	282	67
Ice cream and frozen desserts	1,322	61
Fresh and frozen packaged fish	404	52
Prepared animal feeds	2,265	55
Wines and brandy	228	55
Bottled and canned soft drinks	4,231	72
Flavorings	510	59
Cottonseed oil mills	202	73
Soybean oil mills	100	54
Grease and tallow	523	70
Animal oils, n.e.c.[c]	74	100
Manufactured ice	n.a.[d]	92e[e]
Macaroni and spaghetti	n.a.	51e
Knitting mills, n.e.c.	69	68
Paddings and upholstery filling	181	57

[a] A small plant is here defined as an establishment with fewer than 100 employees. The industries listed are those in which small plants produced 50 percent or more of the industry's value added in 1958.

[b] Source: (90, pp. 108-110).

[c] n.e.c.--not elsewhere classified.

[d] n.a.--not available.

[e] e--estimated.

Table 17. (Continued)

Industry title	Number of small plants	% of industry value added in small plants
Processed textile waste	175	77
Men's and boys' neckwear	353	79
Women's blouses	1,175	72
Women's dresses	4,348	71
Women's suits, coats, skirts	2,547	76
Women's outerwear, n.e.c.	1,070	57
Millinery	780	82
Children's dresses	712	57
Children's coats	348	77
Children's outerwear	684	53
Fur goods	1,649	97
Robes and dressing gowns	255	63
Leather and sheepskin-lined clothing	144	75
Apparel belts	439	70
Apparel, n.e.c.	293	67
Curtains and draperies	751	67
Canvas products	840	82
Schiffli machine embroidery	701	97
Trimmings and stitching	2,167	77
Fabricated textile products, n.e.c.	880	60
Logging camps and contractors	12,765	84
Sawmills and planing mills	15,286	56
Special product sawmills, n.e.c.	471	87
Millwork plants	3,057	62
Nailed wooden boxes and shook	850	65
Veneer and plywood containers	90	53
Wood preserving	282	76

Table 17. (Continued)

Industry title	Number of small plants	% of industry value added in small plants
Wood products, n.e.c.	2,658	68
Mattresses and bedsprings	1,162	55
Household furniture, n.e.c.	90	77
Partitions and office fixtures	1,790	60
Setup paperboard boxes	477	61
Printing: letterpress	12,775	56
Printing: lithographic	3,568	57
Engraving and plate printing	515	62
Bookbinding and related work	939	68
Typesetting	1,166	80
Photoengraving	896	80
Electrotyping and stereotyping	214	71
Industrial gases	476	77
Cyclic (coal tar) crudes	41	75
Polishes and sanitation goods	1,126	51
Surface-active agents	137	70
Putty and caulking compounds	117	86
Fertilizers, mixing only	675	90
Agricultural pesticides and agricultural chemicals, n.e.c.	322	50
Glue and gelatin	256	52
Printing ink	288	57
Paving mixtures and blocks	556	86
Petroleum and coal products, n.e.c.	79	70
Footwear cut stock	470	64
Leather gloves	165	61
Handbags and purses	566	54
Leather goods, n.e.c.	428	89

Table 17. (Continued)

Industry title	Number of small plants	% of industry value added in small plants
Brick and structural tile	496	60
Pottery products, n.e.c.	566	68
Concrete block and brick	1,784	93
Concrete products	3,405	80
Ready-mix concrete	3,586	84
Cut stone and stone products	968	65
Nonmetallic minerals, n.e.c.	246	58
Secondary nonferrous metals	354	52
Brass, bronze, copper castings	643	67
Primary metal industries, n.e.c.	571	84
Sheet metal work	3,071	68
Screw machine products	1,749	73
Plating and polishing	2,618	90
Metal coating, engraving, etc.	977	74
Special dies and tools	5,644	72
Industrial patterns	1,169	94
Vacuum cleaners, industrial	18	100
Machine shops	10,039	68
Boat building and repairing	1,604	58
Transportation equipment, n.e.c.	247	76
Jewelry, precious metal	1,271	55
Jewelers' findings and materials	240	55
Lapidary work	322	81
Dolls	457	58
Marking devices	520	87
Costume jewelry	1,003	52
Artificial flowers	430	66
Buttons	344	66

Table 17. (Continued)

Industry title	Number of small plants	% of industry value added in small plants
Candles	80	50
Lampshades	265	79
Morticians' goods	562	54
Furs, dressed and dyed	129	55
Signs or advertising displays	2,672	78
Umbrellas, parasols, canes	118	71
Miscellaneous products, n.e.c.	1,207	51

which co-exist side by side with the corporate giants of the American economy, evidently at efficient levels of operation. A certain degree of similarity between the Cyprus industrial census of Table 16 and Table 17 is evident. One would note the absence of agricultural raw material industries in Cyprus such as pesticides, agricultural chemicals, and fertilizers. A fertilizer plant proposal is currently under consideration. It is to be recalled that agricultural raw material imports (variable RA) entered significantly the agricultural production function, amounting to 105 thousand tons in 1963. Model 36-S forecasts agricultural output at £ 31.65 mill in 1958 pounds and projects RA requirement to 164.81 thousand tons by 1970.

From the policy standpoint, the development of manufacturing is an important part in the successful economic development of Cyprus. The Willard Thorp report (95) suggested in 1960 a potential of £ 4.25 mill of new domestic manufacturing output. The 1954 industrial census shows only

nine establishments in the category where 100 or more persons were engaged. In 1962 the number of establishments in this category increased to 19. Establishments employing 50 to 99 persons increased from 18 to 32 over this same period. This change in structure indicates the exploiting of available opportunity, and a trend that should be expected to continue with the further industrialization of the economy and higher per capita incomes.

Econometric Findings and Policy Implications

Next to the market size, the heavy dependence of Cyprus manufacturing on foreign raw materials is the most important limitation to manufacturing development. The manufacturing equation of the model (36-S) shows clearly this dependence.

$$Y_M = 6.852 + 0.494\ MR + 0.651\ LTM_{-1}$$

where

Y_M = Value added in manufacturing at 1958 prices

MR = Value of imports of industrial raw materials at 1958 prices

LTM_{-1} = Lagged bank loans to manufacturing at current prices.

The equation is estimated over the 1956-1963 period. The coefficient of determination (R^2) is 0.97. (Y_M also showed strong correlation to trend; $Y_M = 8.688 + 0.558t \quad R^2 = .94$).

Other maintained hypotheses failed to adequately explain Y_M. Among others the following explanatory variables were tried without success. (See Appendix D.) No significant positive correlation was found between Y_M and the stock of capital, suggesting excess capacity in manufacturing.

Excess capacity in manufacturing where indivisibilities of investment are involved is to be expected. The small size of the market may accentuate this factor. The presence of excess capacity in manufacturing may explain the under-estimation of Y_M in the 1964 forecasting; also the depletion of inventory stock could have played a role. Government investment was found a significant explanatory variable. This may be due to the fact that electricity, gas and water are included in Y_M. But the non-privately produced part of Y_M is minor, less than 15 percent, so that the connection between Y_M and government investment could not be justified on other grounds than trend. It was finally dropped in favor of the preferred form of the equation as given.

The important implication of the manufacturing equation is the quantitative connection between Y_M and MR. Manufacturing raw material imports averaged 32 percent of M_I, the investment and raw material good imports in recent years. As the model projections show, this dependence on imported raw materials has serious effects on B, the balance of payments. ($MR = -.880 + 0.348\ M_I$).

From the model 36-S we project GNP to 1970 to be £ 184.14 mill. The rate in growth of GNP is at 5.5 percent per year. Y_M reaches £ 29.68 mill by 1970 and MR, £ 15.14 mill in this projection. (In the Linear Programming formulation of the model, Appendix A, the 1970 value of $\frac{Y_M}{GNP}$ is taken as equal to .17, close to the average between the Chenery trend for countries at the Cyprus per capita income level and the present ratio. Y_M should reach a value of £ 31.17 mill under these circumstances.) MR, correspondingly, if present proportions are maintained, would not exceed the £ 20.0 mill level.

The dependence of developing countries on imported industrial raw materials is typical. What is significant in the Cyprus case is that no alteration of this dependence is in sight. The low number of small size industrial plants which will eventually typify Cyprus industry will hardly be conducive to the development of domestic industrial raw material supplies. From the point of view of raw material availability, the direction of Cyprus manufacturing appears to be in the area of agricultural processing. Food industries are at the same time not hindered by small scale inefficiencies. The resource limitation, points to the direction of industries with high value added at their particular stage of production. In this connection, and from a long range point of view, electronics and affiliated industries show potential.

Manufacturing development, apart from the contribution to the balance of payments, plays an important role in economic development because of its linkage effects. The stimulus of satelite industries encouraged by manufacturing development is a prime factor in promoting cummulative economic growth and a basic ingredient to overall economic development. In the "linkage" sense, the superiority of manufacturing over exclusively agricultural development is significant.

A major obstacle to development policy when it comes to manufacturing development is the uncertainty as to the composition of demand. Often, it is not the scarcity of capital that is the limiting consideration for private investment, but the uncertainty over marketing and demand. For this reason the composition of imports of goods and services by a developing country form an excellent source of information as to what industries

are feasible in view of the already proven demand. Import statistics are very good in most countries and excellent in the case under consideration. The growth of industrial production during the 1960-1963 period was, without a doubt, a response to the buoyant consumer demand during the 50's, demonstrated by the massive increase in imports. A scanty look at the 1962 and 1963 Cyprus imports is given in Table 18.

The minimum efficient size of firms must be established before any policy recommendations can be made for the successful establishment of new industries. A study on size characteristics of manufacturing industries in developing countries is given by Bohr (6, pp. 157-166). Hirschman (60) suggests as a good rule of thumb, that an industry can properly be established in a developing economy as soon as existing demand, judged by imports, is equal to one half of the minimum efficiency size of a plan (taking into consideration locational advantage). Apart from the food industry, where considerable progress has been made (see Table on Cyprus manufacturing), the field of electric machinery and house appliances appears promising. Television sets can be locally assembled at efficient rates of output not exceeding 6-7 thousand sets a year.* From the economic policy point of view, those industries with higher value added are to be preferred. Consideration, however, should be given to forward and backward linkage effects as already pointed out. In the assembling of television sets mentioned above, a start is made by the local production of cabinets and pressing of chassis, expanding to

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*Interview with Mr. John Miquell, Jr., Vice-president, Export Division, Zenith Corporation, Chicago, August 29, 1966.

Table 18. Selected imports by value, 1962, 1963, in millions of pounds[a]

	1962	1963
1. Meat and meat preparations	1.076	1.019
2. Dairy products, eggs and honey	0.854	1.019
3. Fish and fish preparations	0.353	0.415
4. Cereals and cereal preparations	2.126	1.096
5. Sugar and sugar preparations	0.441	0.738
6. Feeding stuff for animals (not including unmilled cereals)	0.442	0.561
7. Margarine: animal, vegetable or mixed	0.186	0.137
8. Mineral fuels, lubricants and related materials	3.341	3.893
9. Medicinal and pharmaceutical products	0.614	0.662
10. Fertilizers, manufactured	0.968	1.292
11. Insecticides	0.116	0.151
12. Rubber manufactures, n.e.s.	0.658	0.626
(tires: for motor cars)	0.325	0.314
13. Textile yarn, fabrics, made up articles and related products	3.906	4.732
14. Non-metallic mineral manufactures, n.e.s.	1.229	1.422
(Glass tableware and other articles of glass for household, hotel and restaurant use)	0.102	0.159
15. Hand tools (including sets of hand tools), tools for machines and hand implements, including agricultural	0.165	0.162
16. Hardware of metal (locks, padlocks, safety bolts, keys, fittings for doors, windows, furniture, vehicles, trunks, saddlery, etc.)	0.184	0.204

[a]Source: (43).

Table 18. (Continued)

		1962	1963
17.	Cooking stoves	0.157	0.217
18.	Electric machinery, apparatus and appliances	2.190	2.303
19.	Television apparatus receivers	0.166	0.190
20.	(Wireless apparatus)	0.133	0.191
21.	Sinks, washbasins, bidets, baths and other sanitary and plumbing fixtures and fittings of ceramic and other materials, all kinds	0.247	0.256
22.	Sinks, washbasins, bidets, baths and other sanitary and plumbing fixtures and fittings of metal (whether enamelled or not)	0.139	0.136
23.	Travel goods, handbags and similar articles	0.082	0.098
24.	Footwear	0.226	0.208
25.	Mechanical refrigerators	0.271	0.319

locally produced transformers and more complex components as experience builds up with time. The transfer of know-how that can be accomplished through such cooperative arrangements is enormous.

It is to be noted, as Stanley and Morse point out (90, Ch. 5, pp. 97-135, Ch. 6, pp. 136-189), that small industry is not necessarily inefficient. Modernization selectivity in products and good management can greatly improve productivity in small industries. The growth path of manufacturing output over the period 1950-1963 with projections to 1970 is given in Figure 4. However, it must be recognized that scale economies are an ultimate constraint to productive efficiency. With the subsequent

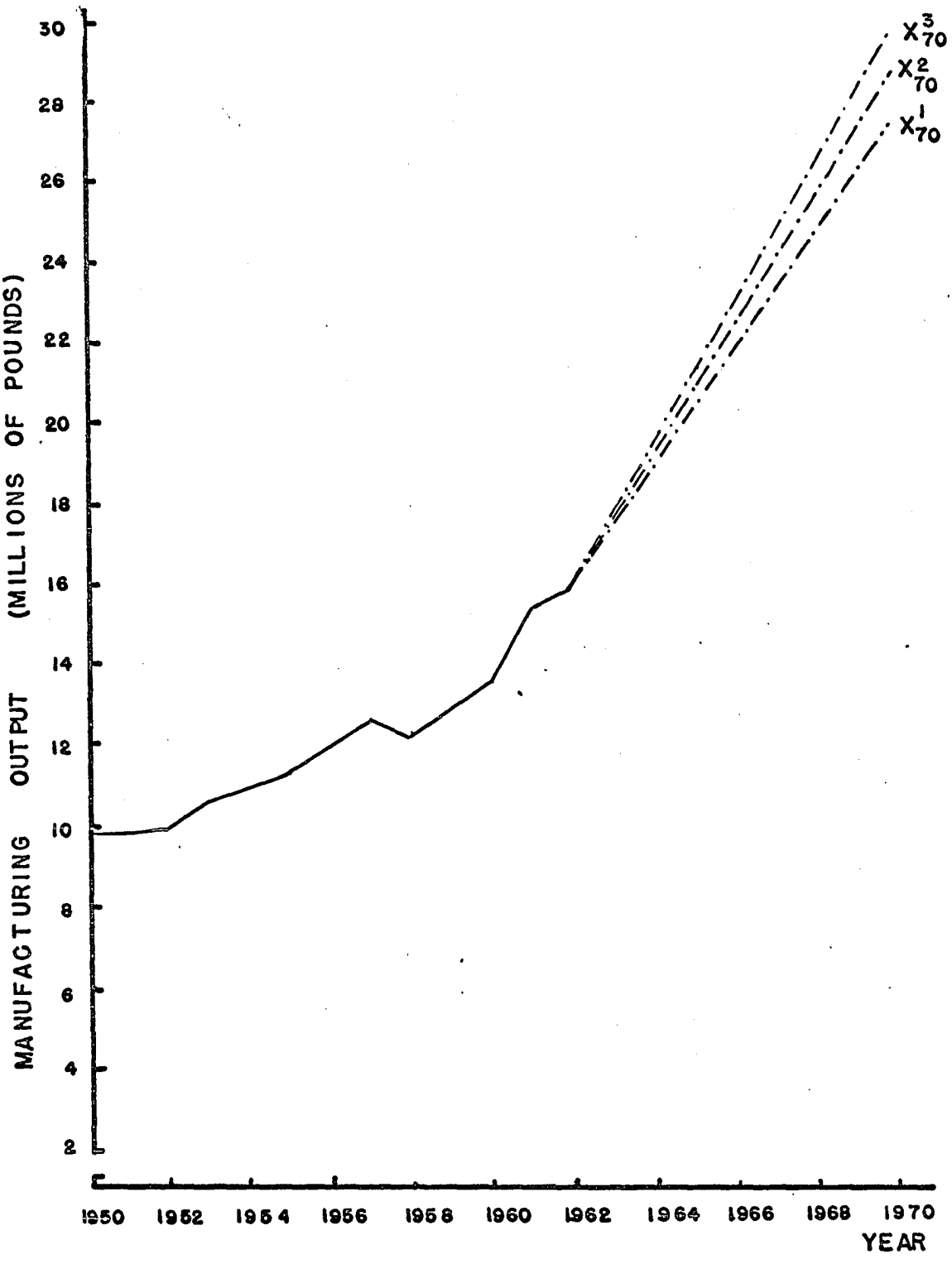

FIG.4 MANUFACTURING OUTPUT, PROJECTIONS TO 1970

development of a skilled labor force, the locational advantage of Cyprus can attract a number of modern industries where a small scale of operation is not always an impairment to efficiency. In such a stage of her development, Cyprus will also depend heavily on trade for export markets. It should remain an essential direction of Cyprus economic policy, the maintenance of broad trade relations. The apparent conflict between the development of domestic manufacturing and liberal trade relations is not easily resolved.

Classical and modern trade theory agree on the need for some protection for infant industry. The policy alternatives are of two kinds,

a. tariffs

b. subsidies.

A combination of these two can be suggested--the imposition of tariffs on a line of imports and the use of the proceeds for subsidizations of infant industry. Such a policy will allow lower protection tariffs than would have been necessary without subsidies. Also, if the domestic industry proves successful, diminishing imports, followed by reduced tariff revenue and the corresponding subsidy will provide a built-in guarantee that protection will come to an end. The problem of continuous protection remains if the infant industry fails to grow up.

Protective tariffs may be seen as an unsound policy for a small country so greatly dependent on foreign markets and tourism for her economic survival. However, in the case of Cyprus there is at this time an urgent need to alter the colonial patterns of trade and restrain consumption imports. If local light manufacturing is to develop, some protection, viewed as a "second best" policy, appears necessary before local industry

can reach efficient competitive levels. That is to say, while liberal trade policy remains the ideal objective, the special circumstances on Cyprus should be taken into consideration.

In summary, the following should be observed before any rational policy recommendations for the future development of Cyprus manufacturing can be made.

1. The very small size of the Cyprus market and its implication on productive efficiency.
2. The high dependence of Cyprus manufacturing on raw material imports.
3. The export potential of the contemplated industries.
4. The linkage effects of proposed industries.

It should be noted that the above considerations are of over-riding importance and will prove more significant to the development of Cyprus manufacturing than a possible alteration in the political future of the island except, perhaps, the creation of more stable trade relations, if Cyprus becomes a part of a larger economic unit. Undoubtedly, if Cyprus becomes a part of a larger economic unit, comparative advantage should benefit the island in the long run where the necessary structural adjustments take place and larger markets encourage productivity. Manufacturing, on the other hand, would hardly be one of the island's areas of comparative advantage.

CHAPTER VI. OTHER SECTORS

Construction

The contribution of construction activity to the Cyprus economy averages 7.6 percent of the gross domestic product, at constant factor costs, for the period 1960-1963. Table 19 gives six construction equations. Equations 1 and 2 are the preferred equations because of their statistical adequacy and also because of their explanatory variables which render equation Y_C a production-demand equation.

Table 19. Selected construction (Y_C) equations[a]

		RES	R^2	F	D-W
1.	$Y_C = 3.816 + 0.131\ NI_{NA} + 0.244\ K_C$	10	.85	28.41	
	t 2.231 5.688 4.350				
2.	$Y_C = 2.763 + 0.139\ NI_{NA} + 0.280\ K_C$	14	.86	41.63	
	t 1.787 7.002 5.283				
3.	$Y_C = 3.424 + 0.218\ K_C + 0.131\ Y_{-1} - 0.107\ L_C$	10	.79	12.86	1.45
	t 1.021 2.910 1.603 -0.422				
4.	$Y_C = 9.690 + 0.186\ K_C + 0.244\ M_I$	11	.79	20.82	1.56
	t 9.748 2.510 4.281				
5.	$Y_C = -1.573 + 0.324\ K_C + 0.249\ NI_{NA} - 0.249\ M_I$	10	.92	36.40	1.86
	t -0.526 5.325 3.861 -1.954				
6.	$Y_C = 5.150 + 0.167\ K_{C-1} + 0.126\ NI_{NA}$	10	.71	12.27	1.42
	t- 2.236 2.226 3.907				

[a]The model variable Y_C includes also ownership of dwellings' contribution to domestic product.

Equations 1 and 2 are estimated over the period 1951-1963 with the observations for 1960-1963 included twice in the estimation of equation 2. The comparative performance of the two equations is given in Table 20. The inequality coefficient of Equation 2 was superior to that of Equation 1, $U_{C2} = .0045$ and $U_{C1} = .0091$ respectively. The individual year predictions are tied. However, Y_{C1} performs better in 1959 and 1964, the recession years; Y_{C2} performs better in 1960 and 1963, years of expansion.

Table 20. Forecasted and actual Y_C values - comparison of weighted (14DF) and unweighted (10DF) regressions

	U[a]	$\frac{DF}{10}$
$Y_{C1} = 3.816 + 0.131\ NI_{NA} + 0.244\ K_C$	.0091	
$Y_{C2} = 2.763 + 0.139\ NI_{NA} + 0.280\ K_C$	.0045	14

	1959		1960		1963		1964	
Variable	Fore-casted	Actual	Fore-casted	Actual	Fore-casted	Actual	Fore-casted	Actual
Y_{C1}	15.485	14.6	15.458	14.3	18.844	20.1	16.218	16.4
Y_{C2}	15.332	14.6	15.289	14.3	19.013	20.1	16.096	16.4
NI_{NA}		72.5		73.6		87.9		79.4
K_C		8.90		8.20		14.40		8.20

[a]Where the closer U is to zero, the better is the forecasting.

The construction equation was the only one to successfully incorporate capital formation as an explanatory variable to production. The t-test on K_C is significant to the 1 percent level. With a shorter completion period in construction, the significance of capital in yearly time series is not unusual. It is to be noted that K_{C-1} enters Equation 6 significantly, but the high correlation of K_C and K_{C-1} prevents the inclusion of both. The

labor variable, L_C, proved non-significant. The data given for labor employment were not reliable, and the negative or zero labor coefficient should not be taken seriously. The preferred form is a combination production demand equation. The role of demand for urban housing explains the significance of non-agricultural national income (NI_{NA}) as an explanatory variable.

The share of gross fixed capital formation in construction to total gross fixed capital formation in the economy ($\frac{K_C}{I}$) averages 57 percent for the period 1958-1963. It rose to more than 60 percent in the period 1961-1963. The share of construction investment to total investment is higher for Cyprus than for countries at similar stages of economic growth.* From figures given by Kuznets, only Puerto Rico has a higher share (69).

The high share of capital formation going into construction is undesirable when evaluated within the objective of economic growth.** The incremental output-capital ratios ($\frac{\Delta Yi}{K_C}$) for the 1960-1963 period averaged to approximately 0.16 for construction and 0.33 for nonconstruction investment (transport and manufacturing). Though these estimates may exaggerate the low level of $\frac{\Delta Y_C}{K_C}$ due to the contribution of construction

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*The concept of stage of economic growth is understood throughout this work in the sense of W. W. Rostow as expounded in his book (81). The resultant of a host of factors which assign a country at a given stage of development can very often be captured in the level of per capita income of the country.

**It must be noted, however, that construction activity is not heavily dependent on imports and as such, for a small highly open economy, is a desirable economic activity. On the other hand to the extent that construction is mainly of the residential type, imports may be stimulated for appliances, house fixtures and the like.

investment to other sectors, the difference is large so as to indicate the existence of higher capital productivity in nonconstruction investment in the short run.

Dwellings investment averaged more than 74 percent of construction investment in the period 1958-1963 and close to 36 percent of all investment over this same years. (Given the low productivity of construction investment as compared to investment in other sectors, K_C was restricted in the linear programming model of Appendix A, to $K_C \leq .08$ GNP without any serious reprecussions on the rate of growth.) With the objective of maximum GNP at 1970 reaching £ 184.14 mill in model 36-S, K_{C70} is equal to £ 29.57 mill. Apparently no major dislocation occurs under such capital investment reallocation.

It should be one objective of economic policy in Cyprus to guide investment away from construction, notably dwellings, and into other sectors, notably agriculture, mining and tourist construction works at this stage of the country's development.

A number of reasons can be suggested for the present high share of investment in the island's total capital formation:

a. the lack of alternative investment opportunities, notably the non-existence of effective capital markets,

b. urbanization and the need of adequate housing,

c. neolocalism in family arrangement, where the newly-wed couple moves away from both parents, together with the custom of dowry that requires that a house be built by the bride's father for the new couple, and

d. a most important consideration - the belief of the Cypriot, conditioned by centuries of political subjugation - that immovable property is the safest of all investment.*

Mining

Mining products have been a major source of Cyprus income since ancient times. Etymologists conjecture that Cyprus derives its name from the metal copper. (Latin: Cuprum). Homer refers to Cyprus as the copper bearing land (59, p. 82; 71; 4a). The contribution of mining to gross domestic product can be seen in Table 2. Mining products are a major source of exports and also the primary source of income tax.

In the period, 1955-1960, mining exports averaged 58.0 percent of the value of all merchandise exports, but the export share of mining products declined to 41.8 percent during the 1961-1964 period. The decline of the mining sector contribution to total output is due mainly to the increased contribution of other sectors. As such the decline is a normal consequence of a more balanced growth and should be welcomed if it were not for the ominous threat of ore exhaustion.

Mining is, for a considerable number of developing countries, a major source of foreign exchange, and Cyprus has been fortunate to be in this category. The income tax contribution of mining companies exceeded 60 percent of the total income tax receipts by the government in 1958, a year in

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*For the last century, however, financial stability has prevailed unhindered in Cyprus. Even in recent years under the stress of civil strife and the colonial war, the Cyprus pound remained stable and strong.

Table 21. Percentage of each section of exports to the total value (F.O.B.)[a]

S.I.T.C. Sections	1958	1959	1960	1961	1962	1963
All Sections	100.0	100.0	100.0	100.0	100.0	100.0
0. Food	28.6	29.6	28.1	31.2	42.5	43.8
1. Beverages & Tobacco	7.6	5.0	4.7	5.9	4.5	6.4
2. Crude materials	54.5	53.9	55.3	51.2	39.9	37.4
3. Mineral fuels	0.6	0.7	0.6	0.5	0.5	0.5
4. Animal & Vegetable oils	0.2	0.2	0.1	0.1	0.4	0.5
5. Chemicals	0.1	0.2	0.2	0.1	0.1	0.5
6. Manufactured goods	0.7	1.1	1.0	0.7	1.0	0.9
7. Machinery & Tpt. Equip.	4.4	5.6	5.7	6.5	6.9	5.9
8. Misc. Manufactured Articles	0.9	1.3	1.3	1.8	2.0	1.4
9. Misc. Trans. & Comds., n.e.s.	2.4	2.4	3.0	2.0	2.2	2.7

[a]Source: (17, p. 52).

which unified income tax laws applied to both the Greek and the Turkish communities. Recent high prices for copper have most favorably effected mineral exports.

The attempt was made to introduce a linear production equation for mining as was done for other sectors. The results proved unsatisfactory. Table 22 gives four mining production equations, which are not included in the models.

The most successful equation appears to be No. 1, but the co-efficient of determination was judged too low. The negative labor coefficient is also unreasonable from the projection point of view since it should not be

Table 22. Selected mining production equations

		DF	R^2	F
1.	$Y_{MN} = 9.192 - 0.802\ L_{MN} + 0.013\ P_{MN-1}$	10	0.54	4.97
	t 5.592 -3.015 1.812			
2.	$Y_{MN} = 6.185 + 0.074t$	11	0.12	1.55
	t 13.165 1.244			
3.	$Y_{MN} = 3.090 + 0.542\ Y_{MN-1}$	11	0.32	5.27
	t 1.952 2.297			
4.	$Y_{MN} = 5.590 + 0.0058\ P_{MN-1} + 0.068(K_t + K_{t-1})$	10	0.043	0.23
	t 3.32 0.647 0.121			

expected to have a continuous linear relation over time. Finally, mining output (Y_{MN}) was introduced into the models as an exogenous variable. This is consistent with the treatment of exports since mining products are destined for exports, subject to exogenous world market conditions.* **

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*The value of mining exports increased significantly in 1965 and in the first quarter of 1966, due to the rise of copper prices. Cuprous concentrates, pyrites and copper cement exports in 1965 were ₤ 6.6 mill, at current prices, compared to ₤ 4.5 mill in 1963. See (8, p. 28).

**Mining output (Y_{MN}) and exports (X_{MN}) were correlated as follows:

$X_{MN} = 1.881 + 1.108\ Y_{MN}$ DF = 11 R^2 = .76 F= 35.33

t 1.496 5.944

The relatively low R^2 and the magnitude of the b estimate must be due: a) to the different deflators used for the two variables, and b) the arbitrariness of yearly observations used. For example, output during the last quarter of year t-1 and the first quarter of t might best explain exports in period t.

Unfortunately for Cyprus, the known reserves of cupreous ore are rapidly being depleted, and no new ore reserves have been discovered. The major impact of a significant reduction in mining activity, apart from unemployment,* will be felt mostly on exports. The X^1_{70} projections of model 36-S show that the balance of payments deficit remains the primary long-run constraint to the development of Cyprus. X^1_{70} projects mining exports (X_{MN}) at a zero average growth rate; the corresponding B, from model 36-S where GNP grows at 3.3 percent, is £ 34.40 mill. X^3_{70} projects X_{MN} at a 5.5 percent average growth rate, anticipating X_{MN} to be £12.77 mill; the corresponding B is then a £ 32.07 mill deficit.

Transportation

The economically meaningful size of a country is often limited because of the lack in transportation facilities. In Cyprus, transportation is no bottleneck to development. A good network of roads connects all villages with marketing centers and provides adequate access to the sea. Table 23 gives the mileage of public roads. For 1963, the island had 3,875 miles of roads, close to 66 miles per 10,000 population. The transportation equation of the model 36-S is given as

$$Y_T = 4.563 + 0.643\ M_{VH} + 0.4498\ LT_{-1},$$

where M_{VH} = the value of communications imports for the year and LT_{-1} the lagged number of lorries and taxies. The strain that communications imports imparts on the balance of payments suggests that efforts should be made for

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*A yearly average of 5.35 thousand were employed in mining and quarrying in the period 1960-1963, or approximately 2.25 percent of the labor force.

Table 23. Mileage of public roads[a]

	1957	1958	1959	1960	1961	1962	1963
Roads maintained by Public Works Dept.:							
Bituminous surface	819	835	863	884	897	944	991
Gravel roads	155	185	183	162	156	134	111
Administration roads:							
Bituminous surface	--	15	--	--	--	119	173
Gravel	1,721	1,730	1,730	1,730	1,730	1,631	1,553
Forestry roads--Gravel	490	505	505	505	570	593	612
Municipality roads:							
Bituminous surface	179	187	187	187	187	293	312
Gravel roads	223	215	215	215	215	215	123

[a]Source:

the development of a more adequate system of public transportation so as to relieve the need for private cars, now so prevelant. It should be pointed out that sales tax on gasoline is a major source of government revenue, however. (See Appendix B, Model 28, Eq. 13). The excessive use of private transportation, a "luxury" consumption, is not unlike Galbraith's "social imbalance" effect introduced in reference to the U. S. economy. In his words, "The final problem of the productive society is what it produces. This manifests itself in an implacable tendency to provide an opulent supply of some things and a niggardly yield of others. This

disparity comes to the point where it is a cause of social discomfort and social unhealth" (51).

In the case of the excessive use of the automobile in Cyprus, a kind of social imbalance in view of the investment needs of economic development, can be suggested. As with consumption in general, however, one can see a number of positive effects that the private auto has had on the economy. These range from labor mobility and a demonstration effect that provide additional incentive to work, and restraints to immigration both to abroad and to the city. The model 36-S projections (X_3^{70}) to 1970 call for £ 22.05 million as the contribution of transportation to gross domestic product compared to £ 9.8 mill in 1958 and £ 13.0 in 1963.

Services

The service sector's contribution (Y_S) amounted to almost 25 percent of the gross domestic product (Y) in the 1960-1963 period. The relatively high share of services to domestic output is not, as is usually the case, an indication of a structurally developed economy responding to an affluent demand. It is rather the undeveloped nature of other sectors, in particular, manufacturing, that overinflate the contribution of services. The model equation for services includes also banking, real estate and insurance. It is essentially a demand equation, (Equation 5, $Y_S = -9.123 + 0.393\ (Y-Y_S)$). Y_S is projected to £ 43.26 mill by 1970 compared to £ 26.6 mill in 1962.

The service sector is important to Cyprus development mainly for two reasons: (1) the small size of the economy and thus the limitations of

alternative activities, and (2) the importance of tourism in the future development of Cyprus. Banking and insurance in particular offer good possibilities for future development. Cyprus banking has been traditionally westward looking due to its strong ties to Britain. No systematic effort was made to attract Near Eastern oil funds or to finance an expanding Near Eastern trade. Lebanon, only 80 miles to the east, has succeeded in becoming the financial center of the Near East, and thus, inspite of her meager resources, enjoys today the highest living standard of the Arab nations. The complete westward economic orientation of Cyprus, inherited from colonial days, precluded profitable association with the East, not only in banking but also in trade and travel. Historically Cyprus prospered when closely associated with her eastern neighbors and when she involved herself in trading with them. The possibility of such association is as good today. Cyprus is the only country in the area that maintains friendly relations with both Israel and the Arab countries. The possibilities of trading with both sides are good, and products which cannot be marketed to one or the other block, can be marketed through Cyprus. Such arrangements are, of course, uncertain--subject to political retaliation. But, on the other hand, there is no reason why Cyprus cannot in some sense become the Hong-Kong of the area. Like Hong-Kong to China, Cyprus can prove beneficial to both the Arab and Israeli sides. This could be accomplished without a political showdown since the island is neither Arab nor Israeli.

Consumption

The consumption equation is of a simple form. Table 52 of Appendix D shows a number of selected consumption equations. Figure 5 gives the path of private consumption over the 1950-1964 period and alternative projections to 1970. The main difficulty apart from the lack of adequate disaggregated data in constructing a consumption function was the abnormal personal income tax situation in recent years. The national government lost her power to tax income because of Greek-Turkish disagreements in 1961. Income tax receipts dropped sharply. The Greek and Turkish communities enacted their own communal laws providing for the imposition of personal taxes in the form of income tax on members of their respective communities. In addition, the largest part of direct income tax falls on foreign companies and not the general population. In a highly open economy where the shareholders of companies are not usually citizens, the effect of this kind of taxation on consumer disposable income is highly uncertain.

An a priori disposable income is estimated on the basis of past trend and future anticipations as $DI = NI - .582T_D$. It is used in estimating the preferred consumption equation $C_p = -1.162 + .942\ DI$. It is of interest to note the negative marginal propensity to save for the period 1958-1963 from the equation $C_p = 20.733 + 1.108\ NI$. To the extent that our data is correct, and this we expect to be the case after 1958, the negative marginal propensity to save during the period shows a strong "Duesenberry

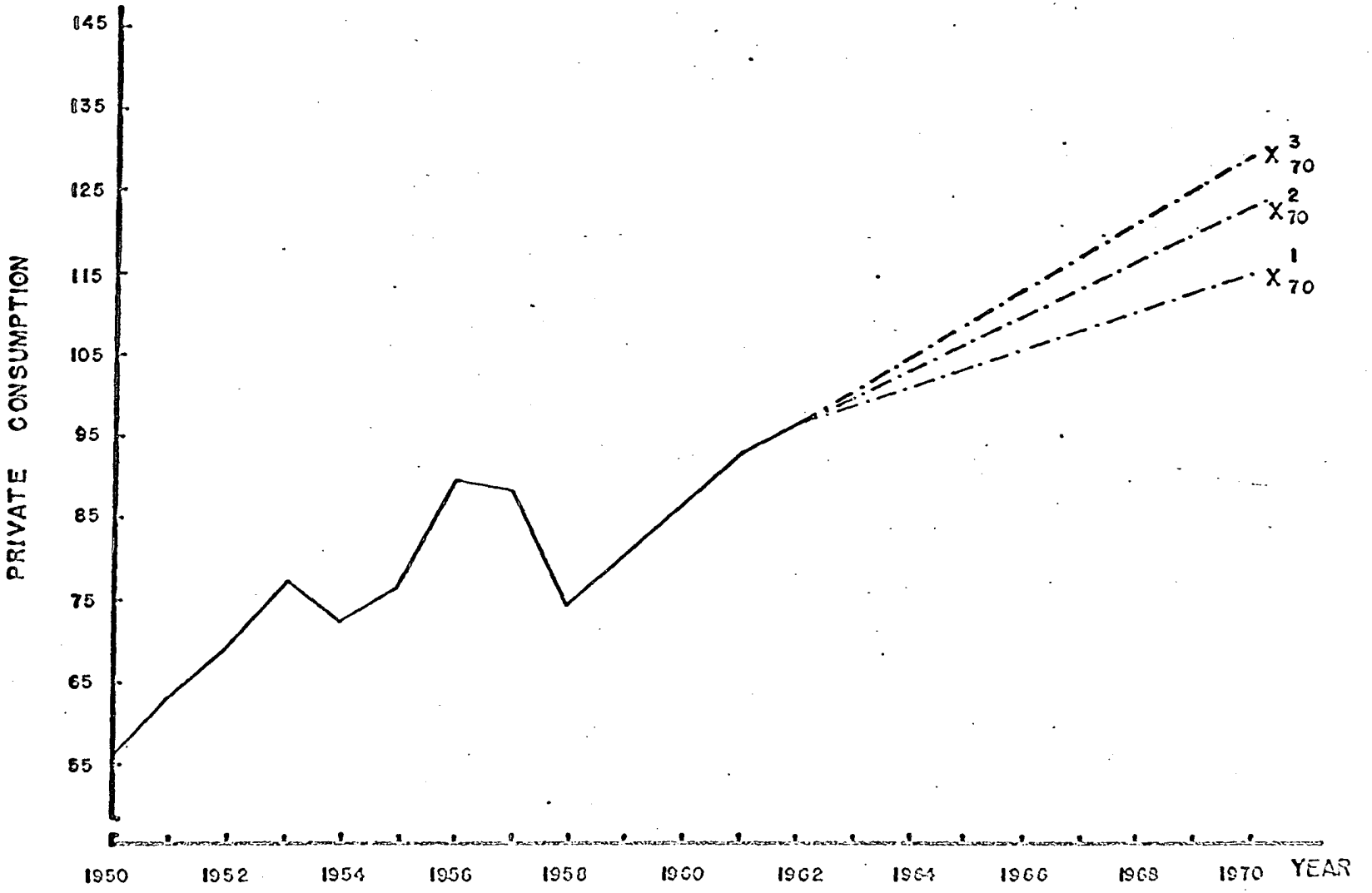

FIG. 5 PRIVATE CONSUMPTION PROJECTIONS TO 1970

Ratchet Effect."* See Table 24. That is, the Cyprus consumer, during the period of economic depression, 1958-1961, tried to protect his consumption standards acquired during the boom, 1953-1957, period. As income fell, Cypriots reduced consumption as little as possible thus reducing saving sharply. The relatively high rates of consumption in the period of 1958-1961 was probably financed by a back log of savings which was forced during the Cyprus rebellion, as well as the voluntary boycott of British goods by Greek Cypriots. The high marginal propensity to consume is especially apparent in 1960, a year in which the country was returning to normal political conditions. In later years the unhampered imports of consumer goods provided an unlimited source of supply. The relative price stability found in Cyprus is partly attributed to the generously available imports to satisfy domestic demand and thus the avoidance of any serious shortage in supply with the subsequent inflationary gap.**

Capital consumption allowance (depreciation), D, is given by Equation 8 in model 36-S. GNP proved a highly significant explanatory variable. This is not a surprise since D is estimated on the basis of GNP in the first place. The ratio $\frac{D}{GNP}$ appears too low.

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*See (48). The Duesenberry consumption function is of the form $\frac{S_t}{Y_t} = a\frac{Y_t}{Y_o} + b$ where S and Y represent saving and income respectively, the subscript t refers to the current period and 0 to the previous peak.

**Note also the underestimation of forecasted 1964 consumption, a year of major decline in income.

Table 24. Average propensities to consume national income[a]

Year	Consumption, C	National Income, NI	$\frac{C}{NI}$
1955	76.9	82.9	.93
1956	89.7	88.6	1.01
1957	88.3	97.9	.90
1958	74.2	90.5	.82
1959	80.9	92.2	.88
1960	87.0	91.8	.95
1961	93.4	102.2	.91
1962	96.7	106.8	.91
1963	103.7	112.4	.92

[a]Note DI = NI - .582 T_D. All values in millions of pounds.

Public Finance

Public finance (government budget) is for Cyprus the major instrument of economic policy. Currently two types of budget exist:

a. the ordinary expenditure budget,

b. the development budget.

Taxation and expenditures are the important direct instruments available to public policy. The policy multipliers and examples of policy mixes give an indication of the efficiency of these instruments in their effect on the objectives of growth and favorable external equilibrium. Chapter IX elaborates in greater detail on the appropriate course of Cyprus economic policy and the use of the government budget as the important instrument of public policy.

Some national planning in terms of goals and means is today practiced by all nations. Developing countries, in need of rapid development, have adopted a variety of planning techniques in the hope of more efficient economic management. For the many reasons discussed earlier that stem from the colonial pattern of Cyprus development, (high consumption rates, unfavorable external equilibrium, minimal insectoral linkage, etc.).planning is essential for the island's economic future.

The cultural and institutional character of the country allows only the indicative, public sector, non-authoritarian type of national planning. Thus, the public finance sector is of exceptional importance in Cyprus development as the carrier of national economic policy. The share of the government sector (both ordinary and development expenditure), to gross domestic product, for the period 1960-1963, was close to 16.5 percent. In most developing countries, this share is much higher. It should be noted, however, that defense appropriations were nill during this period. The small size of the country is advantageous from the planning point of view, though small size prevents the optimum use of government administrative machinery and the realization of what can be called administrative economies of scale. In the framework of traditional theory, economic planning in a developing country can be understood as an essential non-market activity that must provide for the large category of goods and services where externalities are to be found. The very process of growth can be seen as an activity of externalities and thus by its nature become the concern of public policy. In support of this position, one is reminded of the necessary infrastructure, educational needs and large-sum borrowing associated with development, to mention only a few.

The importance of the government budget as the instrument of economic policy in Cyprus warrants a closer examination of its parts. The revenue side is made up of five components in model 36-S. Direct T_D, excise T_E, and import T_M taxes are endogenous. Other taxes T_O, revenue from foreign and domestic loans and foreign and domestic borrowing including grants in aid $T_{ETC.}$, enter exogenously into the model. The ratio of tax revenue to Gross National Product was close to 11 percent during the 1960-1963 period. This is low when compared to the 25-30 percent of similar ratio's found in advanced countries but typical of a developing country. Account should be made of the unusual tax structure during the period which underestimates the tax share in GNP.

The tax equations included in the model are:

Equations:

16. $T_M = -0.736 + 0.318\ M_C$

17a. $T_E = 0.456 + 0.0047\ TB$

17b. $T_E = -0.070 + 0.00468\ TB + 0.0777\ FL_{-1}$ (from Model 28)

18. $T_D = -1.849 + 0.071\ NI$

where

T_M Taxes from imports

T_E Excise taxes

T_D Direct taxes

M_C Imports of non-investment goods

TB Domestic tobacco production (in okes)*

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*1 oke = 2.8 lbs = 1.27 kilograms

FL_{-1} Lagged imports of fuels and lubricants

NI National income

Table 25 gives the percentage share of taxes to total government revenue. The large share of indirect taxes (on expenditures) is evident. Also the very low share of income taxes, especially since 1961, should be noted. The very low share of direct taxes in government revenue is due to the unique political arrangement found in Cyprus since 1960 where the national government does not have the legal power to tax the citizens. Cypriots make income tax contributions to the Greek and Turkish communal chambers.* The unusual tax structure made difficult the effective estimation of equation T_D. A number of other equations attempted are given in Appendix D. Equation 18 was estimated over the 1951-1959 period when direct taxation was still unified. The equation is homogeneous in NI giving a tax rate of 7.1 percent of national income. It should be kept in mind that even during "normal" tax periods, the income tax paid by Cypriots was small considering that foreign companies paid 67.5 percent of the tax. Unfortunately the contribution of foreign companies is not incorporated in the equations. A number of attempts to include mining output or mining exports as explanatory variables were not successful, partly because of their non-correspondence with profits. Profit figures were unavailable. On the basis of Equation 18 and a 5.5 percent average rate of growth in GNP, T_D was projected to £ 10.51 mill in 1970.

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*At present the Greek communal chamber has been dissolved and its power taken over by the national government.

Table 25. Percentage share of each source in the total government revenue[a]

Sources	1958	1959	1960	1961	1962	1963	1964
Taxes on expenditure	37.2	42.4	43.1	47.5	51.0	50.2	52.3
Taxes on income	20.4	15.6	19.7	12.3	8.4	8.0	20.4
Taxes on capital	0.7	0.8	0.9	0.6	0.4	0.5	0.6
Rents, royalties and interest	3.9	4.6	4.7	6.3	7.6	6.6	6.9
External grants	31.1	25.4	19.1	18.5	12.4	11.3	--
Other	6.7	11.2	12.5	14.8	20.2	23.4	1918
Total	100.0	100.0	100.0	100.0	100.0	100.0	100.0

[a]Source: (18, p. 59).

Import taxes (T_M) are the most significant source of government revenue. T_M was explained very satisfactorily by imports of non-investment goods. ($M_C = M_L + M_{DS} + M_O$.) The function was fitted over the 1958-1963 period in order to reflect recent import duty rates and structure. The 1970 projection calls for ₤ 18.72 mill in import duties. Taxable imports M_C are correspondingly projected to ₤ 61.18 mill.

Excise taxes are levied on cigarettes and gasoline. Equation 13 of model 28 (17b above) incorporates approximations of these as explanatory variables. The excise tax equation in model 36-S includes only tobacco as the explanatory variable. T_E is projected to ₤ 3.26 mill on the basis of model 36-S. Similarly total government revenue is projected to ₤ 54.14 mill by 1970. The projections assume a 15 percent rate of growth in T_{ETC}. It is also assumed that a more normal personal income tax structure will prevail.

The expenditure side of the budget (G_C + GI) was projected exogenously at what appears to be low levels relative to the forecasted revenue so that, under the projections, a surplus of ₺ 22.28 mill is anticipated. If the revenue forecast proves reasonably correct, there is no doubt that in view of the many needs, government expenditure will match the revenue. The analysis of government expenditure in recent years is given in Table 26. The share of development expenditure averages close to 23.1 percent of total government expenditure for the period 1957-1963. The share of development expenditure to total government expenditure is similar to that of other developing countries (80, p. 21) but one should note the negligible share of defense expenditure up to 1963.

The abnormal direct income tax situation needs to be corrected as soon as possible, and personal income tax should become a major source of government revenue. Ursula Hicks considers personal income tax "the real thing" when it comes to development finance (58, p. 90). The per capita incomes are high enough and the share of taxes to total income relatively low so that sufficient revenue can be obtained through higher rates and effective collection of taxes. It must be understood that a degree of sacrifice is an essential element for higher saving and investment in the process of development. The farm sector due to its relatively low incomes contributes very little in direct taxes. Provision should be made for a small individual contributions from this sector. Since seasonal unemployment is to be found in the agricultural sector, the government might consider extending the program of labor contribution by villagers to roads, schools, and irrigation works (a form of taxation). A higher share of

Table 26. Analysis of government expenditure (including both ordinary and development expenditure[a]

	Actual Expenditure (£000s.)						
	1957[a]	1958[a]	1959[a]	1960	1961	1962	1963
TOTAL	16,318	14,941	15,829	17,340	17,394	20,331	20,363
Administrative Services	5,592	5,433	6,476	6,845	5,130	5,739	6,168
Development of Resources	3,862	3,163	2,644	2,862	3,730	5,956	5,372
Agriculture	711	672	618	644	676	1,802	951
Forestry	383	342	335	346	360	373	361
Public Works, roads, etc.	1,714	1,075	1,015	1,176	1,429	2,426	2,362
Water Development	980	988	558	525	1,169	969	1,301
Miscellaneous	74	86	118	171	96	386	397
Social Services	3,887	4,090	4,107	3,430	4,180	4,295	4,298
Defence	-	-	-	18	202	188	192
Other	2,977	2,255	2,602	4,185	4,152	4,153	4,333

[a]Not including emergency expenditure. Source: (17, p. 62).

Table 26. (Continued)

	Percentage Expenditure to the Total						
	1957	1958	1959	1960	1961	1962	1963
TOTAL	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Administrative Services	34.3	36.3	40.9	39.5	29.5	28.2	30.3
Development of Resources	23.7	21.2	16.7	16.5	21.4	29.4	26.4
Agriculture	4.4	4.5	3.9	3.7	3.9	8.9	4.7
Forestry	2.3	2.3	2.1	2.0	2.1	1.9	1.8
Public Works, roads, etc.	10.5	7.2	6.4	6.8	8.2	11.9	11.6
Water Development	6.0	6.6	3.5	3.0	6.7	4.8	6.4
Miscellaneous	0.5	0.6	0.8	1.0	0.5	1.9	1.9
Social Services	23.8	27.4	26.0	19.8	24.0	21.1	21.1
Defense	-	-	-	0.1	1.2	0.9	0.9
Other	18.2	15.1	16.4	24.1	23.9	20.4	21.3

direct taxes will, in addition to revenue, give a potent instrument to policy makers in implementing economic policy. Whatever the multitude of considerations that come to bear on public finance, taxation remains an essential tool for raising the rate of capital formation, both in the public and private sectors.

CHAPTER VII. TRADE AND TRADE POLICY

Imports

Model 36-S incorporates four import equations (#9-12). Imports of beverages, tobacco and durables M_L, are given as a function of non-agricultural national income ($M_L = -4.650 + 0.146\ NI_{NA}$). Table 57 of Appendix D shows a number of other maintained hypotheses attempted. Figure 6 gives the growth of imports in the 1950-1963 period as well as projections to 1970. The fairly strong correlation of M_L to time is to be noted. The importance of NI_{NA} as an explanatory variable of what can be referred to as luxury imports, is not surprising in a dual economy where the per capita agricultural income is significantly lower than the income of urbanites. An increase of ten million pounds in non-agricultural income increases "luxury" imports by close to 1.5 million. The projected growth of urban population suggests that this class of imports will keep expanding at an increasing rate unless adequate local substitutes satisfy part of the increasing demand. The projected level of M_L at 1970 is ₤ 16.14 million; NI_{NA} is projected to ₤ 142.4 million.

Equation no. 11 of model 36-S relates imports with domestic substitutes M_{DS}, to domestic agricultural production and to gross domestic product. A most significant result in this equation is the import substitution effect of agricultural production (equation no. 11, $M_{DS} = -7.798 - 0.405\ Y_A + 0.218\ Y$). Imports of cereals are particularly responsive to domestic production. The choice of imports included in the variable M_{DS} was made on the basis of present conditions and also to some

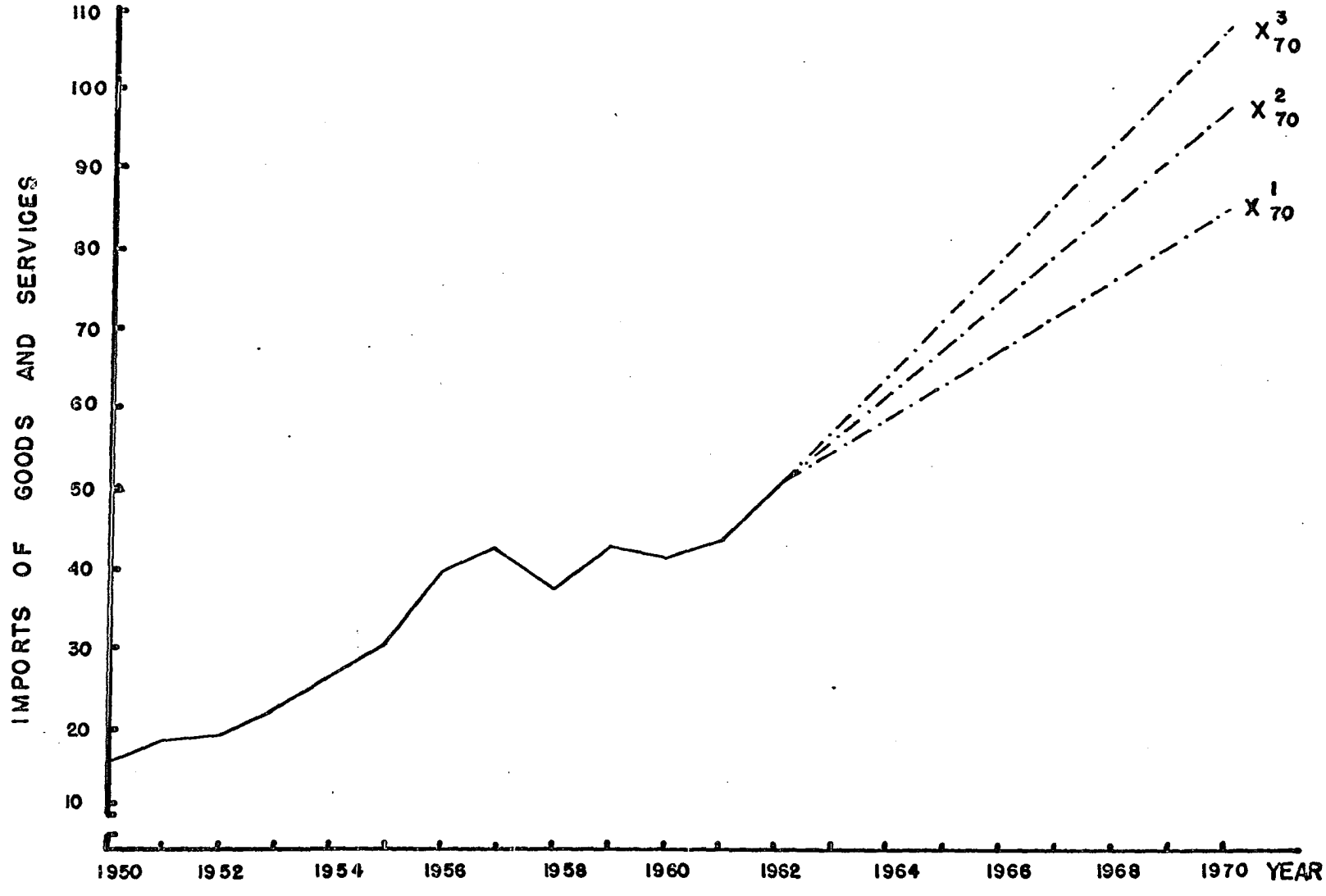

FIG. 6 IMPORTS OF GOODS AND SERVICES, PROJECTIONS TO 1970

extent on future anticipations. Food products (meat, dairy products, eggs, fruits and vegetables), clothing and furniture constitute the main categories included in M_{DS}. The 1970 (ΔGNP = 5.5%) projection calls for £ 17.87 mill of M_{DS}.

Investment and raw material imports are a function of gross national product (No. 10, M_I = -16.217 + 0.338 GNP). Sixty-eight percent of M_I consists of investment goods as equation no. 27 indicates (average for 1960-1963). Through the proportion equations (No's. 13, 14, 15) the importance of M_I as a major input to the economy is noted. The 1970 projection elevates M_I to £ 46.02 million. This component of imports is expected to increase at even higher rates with manufacturing and agricultural development. The availability of domestic substitutes in this category is limited, save the production of fertilizers and some chemicals.

Import residual, mainly imports of fuels, lubricants and the contribution of some services, is included in variable M_0. Model 28 in equation no. 11 gives the number of licensed vehicles (VH-stock) as the explanatory variable. Statistically the explanatory power of VH is strong. (M_0 = -.349 + 0.181 VH) The unusually affluent consumption-oriented Cyprus economy is best exemplified by the high ratio of vehicles per capita, close to one vehicle per nine persons, a ratio similar to those of Western European countries which enjoy much higher per capita incomes. In recent years the value of fuel and lubricants, together with the value of industrial equipment and raw material imports for agriculture, the most important economic activity of the island. Adequate communica-

tions contribute significantly to Cyprus development, but the number of privately owned vehicles effects rather adversely the already large gap between exports and imports. Currently an oil refinery is under construction which is expected to ease the loss of foreign exchange going for oil imports considerably.

A most conclusive outcome of this study is the quantitative estimation of the heavy dependence of Cyprus on trade. The degree of openess in the economy is great and will remain so in the foreseeable future. The country's development will remain export-led, highly susceptible to what happens in the trade sector. The large import-export multipliers, given in Table 8, signify to that effect. From model 36-S, the level of imports is projected to 107.21 mill or 58 percent of gross national product by 1970. This is a rising share when compared to present levels. The increasing share of imports in GNP is a reasonable expectation. The propensity to import is rising with rising incomes since the changing composition of demand usually entails a higher import content. In Cyprus we should expect higher import propensities in view of the need for manufacturing imports which the economy, for reasons explained earlier, will fail to adequately supply from domestic production. Thus the Cyprus balance of payment problem will, ceteris paribus, become worse before it becomes better. The levels of GNP, imports, exports and corresponding balance of payments deficits are given below (Table 27).

Information given by Kindleberger, based on data found in the monthly Bulletin of Statistics of the United Nations, dramatizes the very open character of the Cyprus economy (64). In ordering countries by imports as a percent of national income for 1961, Cyprus ranks second, exceeded

Table 27. Balance of payments projections[a]

GNP (rate of growth)		M	X	B[b]
156.44	(3.3)	85.57	51.17	34.40
173.73	(4.7)	98.65	64.71	33.94
184.14	(5.5)	107.21	75.14	32.07

[a]Figures in millions of 1958 pounds.

[b]Note that B is not strictly comparable to the same variable as given in the Economic Report published by the Republic of Cyprus.

Table 28. Imports (M) as a percent of national income (Y), 1962[a]

... Country ...				
0 - 10%[b]	10 - 20%	20 - 30%	30 - 40%	40 - 50%
India	Brazil	Nigeria	Panama	Algeria
Turkey	Colombia	Greece	Jamaica	Jordan
Spain	Mexico	Sweden	Denmark	Ireland
Finland	Chile	Canada	Switzerland	Israel
United States	France			Iceland

... Country ...	
50 - 60%	60 -
Netherlands	Trinidad
Cyprus	Tobago

[a]The imports as used here are not exactly the same as variable M used in the models.

[b]$\frac{M}{Y}$ expressed in percentages.

only by Trinidad and Tobago. Table 28 summarizes some of the data.

The great dependence of the economy on trade gives ground for a number of policy considerations. It should be recognized beforehand that if Cyprus wants to fully exploit her comparative advantage, she should remain an open economy. The currency, by remaining freely convertible, will bring money costs closer to real costs while reliance on tourism and shipping make currency convertibility necessary. The absence of exchange controls will facilitate the flow of capital, much needed for the country's development. A highly open economy, however, is susceptible to a number of adverse effects. The possible flight of capital abroad and the dependence of the economy on foreign interest for decisions vital to her own welfare are two major considerations. The investment of domestic savings abroad is high and speculative capital movements not uncommon. The Cyprus government has most of her special funds invested in England (25-29). Though such developments are not unrelated to the lack of a Cyprus capital market, they may be the cause and not the effect of that prevailing state of affairs.

A small open economy such as Cyprus' is not helpless in facing the possible adverse effects of liberal trade policy. The direction of capital movement is the result of relative productivities and risks which can be made more favorable by the use of proper fiscal policies. Attractive investment policy, domestic government borrowing and the like should be the objective of long run development policy and not that of trade restrictions. One should not neglect, however, the many special cases such as infant industry, revenue considerations, etc., which will force modifi-

cations of liberal trade. What we are referring to with liberal trade policy are the appropriate directional commitments of policy rather than specific long run arrangements.

The second issue raised by a liberal trade policy, that of excessive dependence on foreign interests, remains for Cyprus a fundamental political issue that must be recognized and be dealt with. Cyprus' ancient and modern history demonstrates the island's dependence on foreign powers. The question facing the policy maker is not one of dependence or no dependence within the consequences of liberal trade policy, but how much dependence. How, in other words, can a small open economy extricate as much as possible in return for the price she pays for economic dependence on her large partners. Cyprus, because of her strategic position possesses a strong bargaining weapon in this respect.

Balance of Payments

The high dependence of the economy on external trade is not unexpected but consistent with theoretical considerations. The degree of balance in resource availability for a small country such as Cyprus is unfavorable. Factor endowment and nation states seldom coincide. After all, boundaries among nations are drawn without regard to economic common sense, but, like islands, are the result of historical or geological accident. The degree of self-sufficiency, as a consequence of the non-economic character of nation states, varies greatly among nations, but it can be expected to be more adverse for countries of small size. The lack of balanced resource availability necessitates trade with other nations so

that specialization and exchange can off-set the narrow base of resource endowment (45). The variety in scale economy efficiencies among industries would tend to bring about specialization and exchange patterns among nations of different size.

The minimum efficiency size is different for different industries due to technological considerations. Small countries will have to specialize in products and services that scale economies can allow and trade with other countries in exchange for the things they cannot produce. (See Chapter V on manufacturing.) Such is the teaching of comparative advantage which appears more relevant for small countries than for larger economic units where regional specialization is possible.

The reliance on trade is the logical outcome of the economic character of a small country. The trade dependence is best illustrated in the development of manufacturing. The possibility of manufacturing exports is a rather difficult undertaking at the early stages of industrial development.

The need for imported raw materials and investment goods will continue to be great in the future as the econometric findings show. It is a characteristic of developing economies that investment exceeds domestic savings in a way that the external trade disequilibrium appears inevitable for the time being. An objective of trade policy is to reduce this gap whenever possible but not at the expense of productive imports, that is, imports contributing to development and growth. The composition of imports can be modified (especially as in Cyprus where the ratio of imported consumer goods to investment imports is very high), and trade policy

should be aimed in that direction. The interest, from the development and trade policy point of view, in tourism, manufacturing and import substitution, shipping, agriculture and mineral exports, is not to close the trade deficit, but rather to develop alternative sources for the financing of further economic development through the appropriate kind of imports. The development of exports will reduce the obligations (loans, aid, etc.) which nevertheless remain necessary in financing the development of a small country. This is especially so when the country operates at low levels of domestic saving and under a non-authoritarian economic system.

There is no unanimity of view among economic theorists as to the proper trade policy when it comes to underdeveloped economies. The traditional comparative advantage specialization and exchange theory is seriously challenged under the dynamic disequilibrium conditions inherent in the development process. The gap between the protectionists and the orthodox free trade school has been narrowing somewhat in recent years. The tendency today is to recommend the adoption of trade policies appropriate to the country's special circumstances and needs (46).

The massive reliance of the Cyprus economy on trade and foreign sources is accentuated by the uncertain future of the British bases on Cyprus. In 1963, the British bases* contributed to the exports of goods and services, on the current account of the balance of payments, 85 percent as much as the contribution of all merchandise exports. The bases'

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*The total base area is 99 square miles or 2.8 percent of the island's area.

contribution for the same year was one and a half times as large as total agricultural exports.* The importance of the bases' contribution to the Cyprus economy cannot be overemphasized. What happens to the British expenditures on Cyprus will have serious effects on the economy and future growth performance which, as the econometric results clearly show, is closely tied to the imports of raw materials and investment goods.

Projections to 1970

The balance of payments projections for 1970 (X_{70}^{3}) appear too optimistic in view of the future of the British bases on Cyprus. As pointed out earier, this contribution is very significant. Recent pronouncements by the Labor Government show a clear intention for a major curtailment in Britain's military expenditures abroad. The rate of growth in exports, assumed for projections X_{70}^{3}, averages 10.9 percent per annum. Figure 7 gives the growth path of exports in the 1950-1963 period together with projections to 1970. A major reduction in British expenditure will require the development of alternative sources of foreign exchange if the same growth rates are to be maintained. In the following paragraphs we investigate the possibility of tourism replacing the present contribution of the bases to the Cyprus economy.

It is assumed that by 1970 the bases' contribution to the current account will be reduced to half their average annual contribution of the period 1961-1963. Such a reduction will entail approximately £ 8.6 mill.**

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*Tourism's contribution was 23 percent of the total merchandise exports for the same year, 1963.

**This figure relates to the "government n.i.e." item on current account.

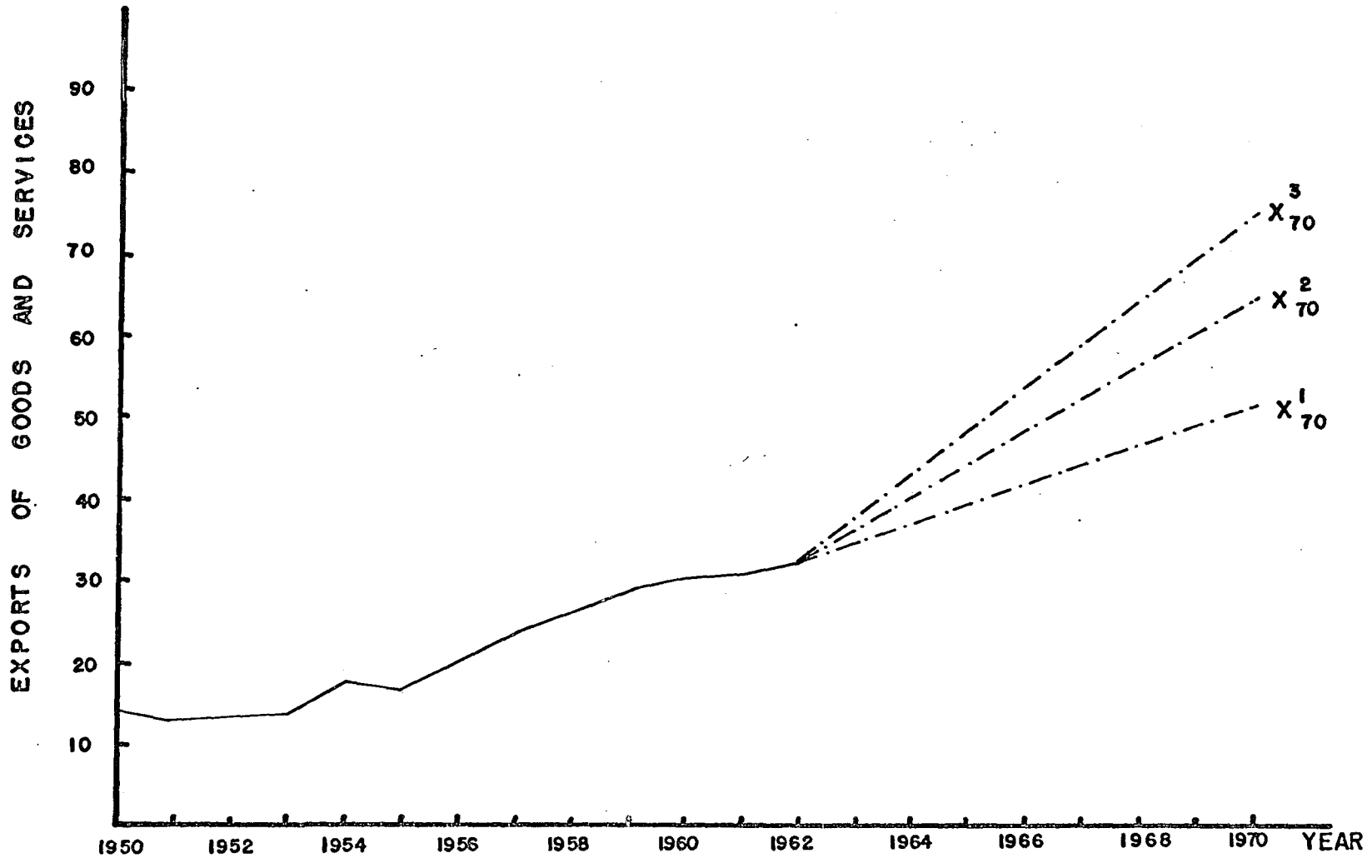

FIG. 7 EXPORTS OF GOODS AND SERVICES, PROJECTIONS TO 1970

If this reduction is to be made up by the inflow of funds from tourism, the 1970 tourists contribution X_T^{70} should equal approximately £ 23.5 mill. Such an increase implies a 27 percent annual rate of growth in income from tourism (base 1961-1963). If such a growth in tourist revenue is to be associated with a corresponding growth in tourist visitors, the necessary number of tourists in 1970 must reach the 351 thousands compared to the 70.4 thousands in 1963. Similarly, assuming that the 1961-1963 tourists-to-hotel beds ratio prevails, the number of hotel beds called for by the end of 1970 must be close to 32 thousand. That is a rate of growth in hotel beds available equal to the necessary tourist visitor growth rate of 27 percent. Such a growth in tourism is seen necessary in order for the balance of payments deficit to remain at its projected level of £ 32.07 mill and for the rate of GNP growth to be at 5.5 percent a year.

Such projections in the growth of tourism may appear at first sight unrealistic, yet those who study closely the tourist potential of Cyprus appear optimistic. A recent interview by Mr. Costas Montis, Director of the Department of Tourism, suggests that 70 million tourists move about the Mediterranean area every year, and increasingly more toward the Eastern Mediterranean (101). Mr. Montis also revealed that British interest in Cyprus tourism is especially strong. The intensity of British interest is prompted by the "Wilson austerity measures" which greatly limit sterling convertibility by British tourists (to the insignificant sum of £ 50 per person). Such measures, if continued, will greatly curtail the flow of British tourists to Europe. Cyprus, on the other hand,

as part of the British Commonwealth, is in the same financial market as Britain; thus British tourists traveling to Cyprus do not face any currency restrictions. Tourism is highly income elastic and the continuously rising European, American, Israeli and Arab incomes are a strong guarantee of tourism's future growth. It is unfortunate that the political uncertainty over Cyprus which has prevailed over the last three years prevents the taking of full advantage of such hopeful developments.

In the meantime, it is assumed that payments and capital transfers can finance the inevitable deficit in the balance of payments apart from what happens to the composition of the current account after the anticipated decline in British military expenditure. The clear implications of the elimination of the British bases must be fully understood by the Cyprus policy makers and alternative sources of financing be fully explored. If subsequent capital transfers from abroad are channelled to productive investments, as suggested earlier, domestic production can hopefully improve sufficiently so that import substitution and rising exports can close the balance of payments gap to manageable proportions. The balance of payments disequilibrium, in the meantime, will remain the prime threat to the economic welfare of Cyprus. No country can consume more than what it produces or borrows. The Cyprus standard of living and future economic growth is thus unequivocally tied to the island's ability to produce or buy abroad.

What can be hoped for in the longer run for a small country such as Cyprus is the development of special proficiency in a particular type of industry most suited to the small country's position and resources (or

lack of them). The grand example of such specialization is Switzerland, itself a relatively small country.* With the exception of the poorly marketed Commandaria wine,** no special Cypriot product exists such as the steel and glass from Sweden, cheese from Denmark, flowers from the Netherlands or watches from Switzerland. The Cyprus policy makers should give careful consideration to the development of a typical Cyprus product or service. It could be suggested that tourism is the best such possibility for Cyprus, yet there may be room for wider specialization in areas related to tourism. Indeed extended specialization is necessary if one considers a certain degree of autarchy as an objective of economic policy.

Specialization on tourism alone makes Cyprus highly susceptible to the uncertainties of international politics. No country can afford a major reliance of her economic welfare on forces so remote from her control. At heart this dependence on uncontrolled forces is the major difficulty with too great a reliance on tourism or any other single product. A certain degree of autarchy is therefore recommended.

In the case of Cyprus, if the dependence on foreign markets is inevitable, then probability considerations (i.e. risk minimization) suggest specialization in a variety of exportable goods and services. The devel-

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*We are here referring to the Swiss watch industry and also banking.

**A sweet, port wine produced from grapes grown on the southern slopes of the Troodos mountain range.

opment of shipping is seen as one such possibility which, under autarchy considerations, acquires additional importance. Cyprus, for a variety of reasons, has not developed any significant merchant marine. Fishing is rarely attempted and nothing comparable to the profitable involvement of the Greek islands with the sea is found in Cyprus. The small size of Cyprus, the lack of resources and the associated heavy dependence on the foreign sector are fundamental characteristics of the economy of which the policy maker should be constantly reminded. The development of a significant merchant marine appears a good possibility. But in spite of the adequate development of exportable goods and services, the many disadvantages of a small nation remain strong.

Tibor Scitovsky, in considering the unstable character of trade relations of small countries, writes (86):

> "(For) mass-production methods to become profitable requires a market outlet that is large, homogeneous, and stable over time; and these requirements rule out reliance on export markets, except to a very limited extent. For export markets...are regarded as highly precarious-liable to be dosed off suddenly for political reasons or as a result of balance-of-payments difficulties...We may conclude therefore, that if an economy is too small technologically - in the sense of providing insufficient market outlets for output even of a single modern and efficient plant - then international trade is of little avail."

Scitovsky, in offering a solution to the uncertainties of trade among nations, continues:

> "Economic union would be better, provided it guarantees not only free and unrestricted trade but also complete stability of exchange rates among members of the union."

Such a union will also introduce competition among the industries of the different countries and promote efficiency on this ground.

Competition in markets that can only support one or two well protected industries is usually very weak. The high degree of dependence on international trade by a small country such as Cyprus provides a factor which must be considered seriously in the determination of the island's political future.

In the meantime while Cyprus remains an independent nation, certain autarchy considerations must be taken into account by the policy maker. Such considerations will force economic performance below the optimum degree of international specialization. Unfortunately these considerations are inevitable. To suggest that Cyprus become the resort area of the Near East may be economically very sound since such a specialization would serve a mountainous, pine-covered island's comparative advantage well, when surrounded by desert, oil rich lands. But a policy maker with the consistent long run welfare of the country in mind cannot recommend such an exclusive reliance on tourism alone. Until Cyprus becomes part of a larger economic unit or until international relations are radically altered, the development of a reasonable degree of autarchy inevitably becomes an additional objective of economic policy. Maximum development of agriculture, domestic manufacturing and diversification within the trade sector become an integral part of development policy. On the other hand, the dependence of Cyprus on the unpredictabilities of international trade will remain strong and become progressively more precarious with the island's further economic development (i.e. manufacturing raw material dependence on foreign supplies, export-led growth, etc.)

The very open nature of the economy introduces another difficulty in Cyprus development. To the extent that national planning of the non-authoritarian indicative kind is essential to optimum economic development, and we assume that is it as the period 1960-1963 indicates, the great dependence of the economy on trade introduces a significant unknown to Cyprus planning and economic forecasting (4).

Not all is gloomy for small nations, however. Kuznets, in attempting to explain the success of some small nations with their economic development gives great weight to the capabilities of small countries for quick response to changing conditions such as trade patterns, institutional elasticity, economic integration and a stronger sense of community, which Kuznets calls greater "social invention (68). A strong community sense is hardly one of Cyprus' assets, however!

All that has been said up to now presupposes that the most critical issue facing the island, that of the far-reaching conflict between the Greek and Turkish peoples of Cyprus, will soon be resolved, and in a way that the economic unity of the island will be preserved. Conflict, according to Boulding (7), may be defined "as a situation of competition in which the parties are aware of the incompatibility of potential future positions and in which each party wishes to occupy a position that is incompatible with the wishes of the other." In the case of Greeks and Turks on Cyprus, the wish of both groups to occupy positions which were, in their thinking, incompatible, led to open conflict late in 1963 and early 1964. A state of political uncertainty has prevailed ever since. Currently Greece and Turkey, under Western insistence, are engaged in

secret negotiations the outcome of which is still uncertain.

This study was initiated with the intention of studying the Greek-Turkish conflict on Cyprus and seeking to bring economic theory and practice to bear on this problem. Data limitations prevented the search in that direction at this time. What follows is a brief outline of the problem and some suggestions for further study in this direction.

CHAPTER VIII. THE ECONOMICS OF THE GREEK AND TURKISH COMMUNITIES

The Background of the Conflict

The political settlement of the problem now in sight will prove only a temporary accommodation unless the deeper roots of the conflict are gradually but deliberately eliminated. It is suggested that since the economic sphere of life has been the primary means of interaction between the two communities, it should be the deliberate objective of economic policy to bring about the greater economic interdependence of the two groups.

The Greek and Turkish communities on Cyprus co-existed peacefully for 387 years. While the mainland Greeks and Turks fought bitter wars during the 1820's in the Greek War of Independence and the Balkan Wars early in this century, the two Cyprus communities lived together in peace.*

On Cyprus, no apparent differences can be seen between the two peoples. No specifically Greek or Turkish occupations are easily discernable. It is virtually impossible to distinguish by sight the houses, stores or farms of the different communities, and the popula-

*We must note that isolated incidents of conflict did take place. Upon the outbreak of Greece's War of Independence in 1821, the Turkish governor of Cyprus summoned the archbishop and the bishops and accused them of organizing a plot in support of the revolt in mainland Greece, and, without warning, massacred them.

tion distribution is not drawn on communal lines. As shown later, however, there exist significant income discrepancies between the two groups. The two communities are for all practical purposes spatially integrated.* (See Figure 8, page 149.) According to the 1960 census, the Greek to Turkish population ratios were 81.14 and 18.86 percent respectively. Detailed figures on population are given in Table 72. Of the total population of the island, the 1960 census showed a decrease in the Greek population from 80.3 percent in 1946 to 77.1 percent in 1960. The Turkish population showed an increase of 0.3 percent, from 17.9 percent in 1946 to 18.2 percent by 1960.

Out of the total number of 634 villages and towns, 114 are mixed. Purely Greek or Turkish villages are side by side, usually only a few miles apart and often adjacent to each other. For all practical purposes, the population of Cyprus is not distributed on ethnic lines. This is the major reason why partition of the island would be costly and economically unsound, apart from the fact that it would perpetuate the conflict.**

Cultural Dichotomy

Though the two communities lived next to each other scattered throughout the island, traded and intermingled economically, they remained

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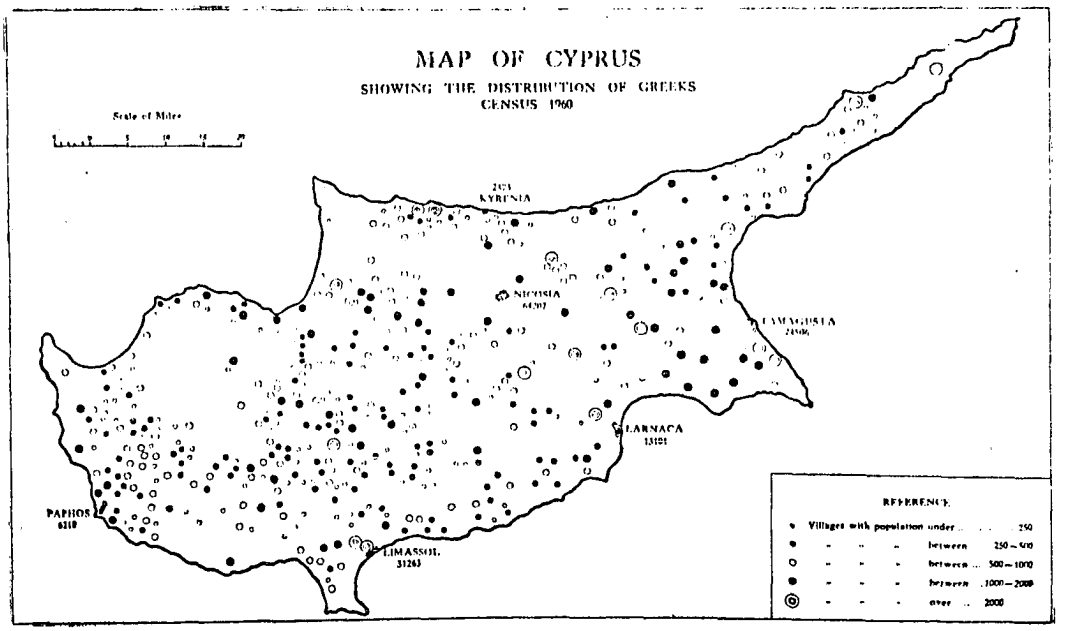
*Exclusively Greek or Turkish communities do exist. Spatial integration is meaningful when looking at population distribution by district (there are six administrative districts in Cyprus).

**For more on partition, see (79).



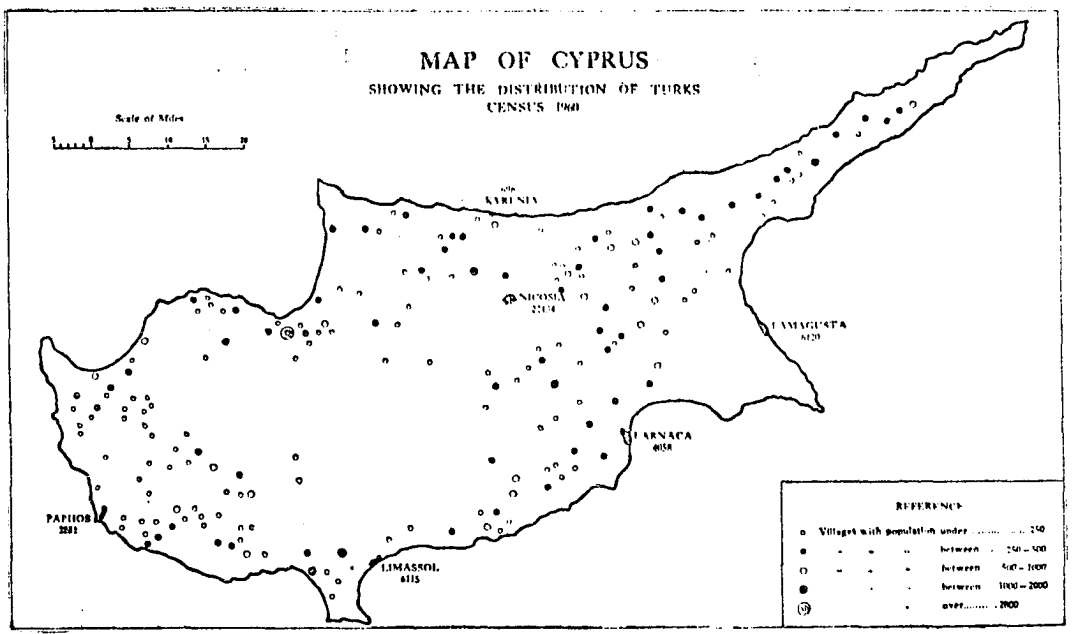


FIG. 8. DISTRIBUTION OF GREEKS AND TURKS ON CYPRUS

distinct throughout the centuries and maintained clearly separate ethnic loyalties. Differences in origin were reinforced by differences in language and religion. Religion in Cyprus, as in most traditional societies, is an integral part of the culture and the main carrier of "heritage" from generation to generation. The religious factor prohibited intermarriage, and social segregation is accepted as the natural way of things by both sides.

The development of national states and the concept of national identity in a moralistic sense, and the subsequent emergence of Greece and Turkey as national states, gave rise to two separate poles of attraction for the people of Cyprus. This development accentuated the differences between the two communities and perpetuated the dichotomy and cultural segmentation of the Cypriot society to its present dangerous proportions. In such cases of divergent social attitudes and aspirations rooted in the historical past, education can play a significant role in cultivating more tolerant attitudes and in promoting reconciliation among the communities. Unfortunately, education, especially at the high school level, not only failed to be a force of reconciliation, but instead contributed to the permanence of the communal dichotomy. The Greek Cypriots attend Greek schools and are taught Greek history that unduly degrades the Turks. The Turkish Cypriots, in their respective school system, learn that Greece and the Greeks are the national enemy. Universal primary education was introduced by the British in the 1920's, but the two communities attended separate schools. As D. Jennes puts it (61):

> "... England sanctioned the dichotomy she found in the island and even promoted it to the best of her ability by leaving the educational control of the Turkish minority, one fourth of the population, in the hands of the Turkish Cypriots, and of the Greek speaking majority in the hands of the Greek Cypriots."

Secondary education during the British rule and after independence was in the hands of the respective communities and, what is more significant, was directed by the Ministries of Education from Greece and Turkey. University education was sought abroad, in England, Greece, and Turkey. Out of 3,274 persons with university education on Cyprus, 41.3 percent attended Greek universities, 13.5 percent Turkish, and 45.2 percnet other universities, mainly British. There is no university on Cyprus as of now (Vol. 5, 15).

Educational standards in Cyprus are good and, by Middle-Eastern standards, very high. Table 29 gives some educational characteristics of Greeks and Turks. Greek educational standards are superior at the elementary level and also in general literacy. The Turks show a slightly higher proportion of university education.

Table 29. Educational characteristics of Greeks, Turks and others.[a]

	% Greeks	% Turks	% Others
Illiterate: 7 years and over	16.1	23.6	5.3
Never attended school: 5 years and over	18.6	26.3	7.8
Elementary school: attended	62.9	55.5	34.8
Secondary and technical	16.6	16.1	48.0
University	0.68	0.71	4.27

[a]Percent of respective populations. Source: (Vol. 5, 15)

Though a fairly good educational system exists in both communities, there never developed in Cyprus an intelligentsia that "crossed the lines". There never existed a common educational policy to educate the two communities of their common bonds and interest. No deliberate attempt was made to integrate the Cyprus society in the social and economic aspects of the island's life. The process of education itself remained a means promoting the further separation of the two ethnic groups and an instrument serving a fierce and devisive nationalism. No effort was made to learn each others' language, customs, or traditions. To the Greek Cypriot, the Turk remained a "barbarian" like all non-Hellines were to the ancient Greeks. To the Turk, the Greek was the majority which was to be feared.

Apparent cordial relations between the two groups prevailed though without strong foundations. The essential dichotomy of the Cyprus society persisted through the last centuries and when the question of political power arose, late in the 1950's, with the unsuccessful attempt of the Greeks of Cyprus to unite Cyprus with Greece, the first incidents of violent conflict occurred. In 1957, communal strife erupted.* It

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*The question of political power was faced by the two communities in the early years of the British administration. It is interesting to note that after 82 years of British rule, the situation remained essentially the same.

> "...the British cabinet in London...desired to consult the Cypriots themselves on every important issue... It therefore proposed to set up a council, representative of the entire population, to advise the high commissioner and his small council of English officials concerning the island's conditions and needs. This proposal immediately stirred up a violent controversy over the proportionate representation of Greeks and Turks in the new council, the Greeks claiming that it should correspond to the proportion of the two peoples in the island's population...and and Turks demanding absolute equality... After much discussion, England decided in favor of the Greek Cypriots, and in November 1882 established...a Cyprus Legislative Council..." (61, pp. 120-121).

was an unfortunate event in the history of modern Cyprus and her efforts for economic development.

Some Thoughts on Economic Integration

It is our contention that Cyprus' problem will not be solved by a mere political arrangement. It will continue to erupt as long as the basic forces which underlie the present crisis are not altered or eliminated. Any political arrangement acceptable to Greek and Turkish Cypriots with the blessings of Greece, Turkey and the West can settle the present conflict. Such a political settlement will resolve the present crisis and avert a war between Greece and Turkey, but it will not in itself remove the long established forces that sustain the present anomalous situation. No attempt to resolve the essential nature of the Cyprus problem can be made unless a political settlement conducive to such a resolution is first accomplished. But such a settlement must have in it elements of a dynamic nature such that in the long run will bring the two communities closer together. The Cyprus society must be more fully integrated if it is to survive. Any attempt toward fuller integration, however, must accept the basic differences that persist between the two groups. Integration and unity in the Cyprus case cannot mean uniformity or the elimination of cultural traits and identity. What can be hoped for is a change in the order of priorities in loyalty by the two communities. The present relationship between the two communities should be altered in favor of more interaction and interdependence. Such an objective must be pursued by deliberate public and pri-

vate policy.

An effort of this sort is not an impossibility in the case of Cyprus. There are within both communities strong elements of moderation and vision that will welcome a long range plan with the purpose of making life easier and more harmonious on Cyprus. It is becoming increasingly evident to the Cypriots that what is now happening can be averted in the future only when the two communities come to realize that a lasting solution of the problem depends on them alone and that they must do something to bring it about. As mentioned earlier, the idea of partitioning the island into Greek and Turkish territory has been suggested as a solution. From purely economic considerations, partition would be disastrous for the minority. Such partition would prove relatively more costly unless massive outside aid is given to both sides.* Indeed the elements of voluntary separation already practiced on Cyprus is the only reasonable explanation that can be given for the apparent discrepancy between the economic conditions of the two communities in favor of the Greek majority shown by subsequent estimations.

While accepting the basic cultural differences that characterize the two communities, what can economic analysis suggest in terms of a long range policy contributing to the lasting and harmonious co-existence of the two ethnic groups? Part of the answer lies in bringing about the complete economic interdependence of the two communities.

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*For a rigorous theoretical discussion on this topic, see (5).

The nature of the Cyprus society is such, as it developed through its historical evolution, that between the two communities the major area of possible interaction is the economic sphere of life. While religion, language, ethnic origins and all that is understood with the word "culture" is different in the two groups and will remain so for a long time, the market place remains the place of interaction between the two peoples.

Relative Communal Contributions to Gross Domestic Product

On the basis of the available statistical information (Appendix E) the contribution of the two groups to gross domestic product is here given (Table 30). The average contributions for 1963 are estimated at 80.4 percent for the Greek community and 13.4 percent for the Turkish community. Equations 1, 2, and 3 below show the basis on which the estimations were made.

Greek percentage contribution to gross domestic product, Y(G):

$$(1) \quad Y(G) = \sum_{i}^{n} a_{ig} Y_i$$

where a_{ig} = the percentage share of G to sector i, i = 1 to 7.

Similarly for the contribution of the Turkish sector to gross domestic product, Y(T):

$$(2) \quad Y(T) = \sum_{i}^{n} a_{it} Y_i$$

and the contribution of other groups:

$$(3) \quad Y(O) = \sum_{i}^{n} a_{io} Y_i \ .$$

The subsequent estimations are based on the data of Appendix E. Wherever data were not available, as for construction and services, a

G = 84% and T = 16% were used.

The numerical application of equation 1 gives:

$$(1') \quad Y(G) = a_1 Y_A + a_2 Y_M + a_3 Y_{MN} + a_4 Y_C + a_5 Y_T + a_6 Y_S + a_7 Y_G = (.831)(24.5) + (.918)(16.6) + (.241)(6.3) + (.81)(28.2) + (.6833)(5.6) = £ 91.02 \text{ mill.}$$

Similarly for equation 2:

$$(2') \quad Y(T) = (.121)(24.5) + (.061)(16.6) + (.012)(6.3) + (.150)(20.1) + (.115)(13.0) + (.15)(28.2) + (.272)(5.6) = £ 14.31 \text{ mill,}$$

and also for equation 3:

$$(3') = Y(O) = 113.8 - (91.02 + 14.31) = £ 8.5 \text{ mill} .$$

In the estimations above, we make use of the information given in Table 30. For definitions of variables, see pp. 39, 40.

Table 30. Summary of communal contributions to gross domestic product

Sector	Greek Contribution Y(G)	Turkish Contribution Y(T)	Other Y(O)
	%	%	%
Y_A	83.9	12.1	4.0
Y_M	91.8	6.1	2.1
Y_{MN}	24.1	1.2	74.7
Y_C[a]	81.0	15.0	4.0
Y_T	84.5	11.5	4.0
Y_S[a]	81.0	15.0	4.0
Y_G	68.3	27.2	2.5

[a]No figures given, rough estimates.

On the basis of the above, an inequality coefficient W_C is calculated (5).

$$W_C = \frac{Y(G)}{Y(T)} - \frac{P(G)}{P(T)} = 6.36 - 4.24 = 2.12$$

where P(G) = percent of Greek population,

and P(T) = percent of Turkish population.

The population percentages were, in 1960:

G = 77.1%
T = 18.2%
O = 4.7%
100.0% Total

That is, the Greeks with 77.1 percent of the population had 80.2 percent of the income and the Turks with 18.2 percent of the population had a low 12.6 percent of the income. Though these estimates are for 1963, based on the 1960 census, the relative income shares are expected stable changing only gradually over time.

The reasons for this apparent discrepancy in income levels between Greek and Turks on Cyprus are not immediately apparent. The following can be suggested. A theoretical explanation of this discrepancy can be given by the high degree of voluntary segregation between the two communities and the fact that the majority tends to realize a more balanced availability of resources.

Indivisibilities must enter here in an essential way. For example, the higher rates of illiteracy found among Turks at the elementary level may not be unrelated to the inability of small Turkish communities in mixed villages to afford their own Turkish school or even meet government student/classroom requirements. Education, especially at the ele-

mentary level, follows completely communal lines. Finally, the interdependence of the two communities (especially of the minority) is nowhere demonstrated more forcefully than in the present economic state of the Turkish community. A large part of the Turkish population (about 40 percent) is isolated in enclaves that sought to form autonomous economic units since early 1964. Such an arrangement proved disasterous to the economic interests of the community which now wholly depends on aid from Turkey for its economic survival.

An historical explanation for the low relative income share of the Turkish community is also available. Cyprus lost its merchant class when it was conquered by the Crusaders. Soon after the Turkish occupation of the island (1571), native Cypriot moneylenders and merchants became a new element in the social structure of the island. Turkey strictly prohibited Jews from the island. The disappearance of both Venetian agents* and Jews created a commercial vacuum. This vacuum inevitably drew in the Greek Cypriot peasants since their Turkish masters were more interested in settling their colonists in agriculture than in trade (59, 61).

A number of qualifications are in order on the above relative income estimations:

a. The measure of income shares given tends to be in terms of ownership of factors other than labor.

b. Most of the shares are in terms of gross output, not value added.

c. No wage rates by community or other sources of income were available.

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*The Venetians ruled Cyprus from 1489 to 1571.

d. No allowance is made for tax contributions, transfer payments, subsidies and the like which will effect relative income shares.

If the relevant data were available and one of the objectives of national policy were to minimize the inequality coefficient, $W_C = \frac{Y(G)}{Y(T)} - \frac{P(G)}{P(T)}$, one could suggest the following operationally possible approach. Within the framework of aggregate policy models, such as presented earlier, separate communal equations can be incorporated in a model. This is not an impossible task. Estimation of sectorial supply equations and production functions can proceed by the knowledge of communal inputs and factor ownership. The knowledge of communal input shares at two or three census periods is sufficient to extrapolate in other years on the basis of available totals and the communal shares. Time series estimation can then proceed as usual. The incorporation of communal functions into a model will then allow the minimization of the inequality coefficient via the use of relevant policy instruments, notably taxation and government investment.

It may be that a conflict of objectives may arise between the minimization of the inequality coefficient and economic growth. On purely theoretical considerations, economic integration is shown to be beneficial to economic efficiency and, ceteris paribus, conducive to growth. In a small economy where market size limitations are a major constraint to development, further divisions based on non-economic considerations are assumed to be detrimental to the economy. In recent years when Greek-Turkish antagonism was at a peak, the Turkish community pursued a policy of economic separation from the Greek majority. Such a policy

necessitated undue duplication of production facilities. For example, the Cyprus Coca-Cola company was in Greek hands. Therefore the Turks developed their own substitute for it causing economically unjustifiable duplication, especially for a small country. Similarly for a number of other activities, notably transportation, duplication also took place. Economic separatism has proved damaging to the whole economy but much more to the Turkish minority. As it was pointed out earlier, the majority has a much more balanced availability of resources and can, in addition, take advantage of whatever economies of scale are available. To demonstrate the above, we resort to the aggregate Cobb-Douglas production function and apply it to the manufacturing sector.

From the industrial census of 1962, the information given in Table 31 is derived.

We assume that the manufacturing production function is of the type $Y = \varphi L^a K^b$, where $a = 2/3$ and $b = 1/3$ and $\varphi = 1$.

We also assume the productivities to be the same for both the Greek and Turkish sectors. This may appear too stringent an assumption, yet both communities use the same machinery, and the educational endowment of the labor force is not significantly different. (See Table 29.) Furthermore, the communities are spatially integrated as shown earlier, and no regional advantage can be realized by the one community as compared to the other. Scale economies may be one factor in favor of higher productivity in the Greek sector. The difference between the actual output proportions given in Table 31 and the estimates obtained by employing the Cobb-Douglas function under the same communal productivities, can be

Table 31. Manufacturing industries, 1962, by ethnic group[a]

	Establishments engaging 5 persons & over		Establishments engaging 1-4 persons	
	No.	%	No.	%
No. of Establishments - TOTAL	910	100.0	11,090	100.0
Greek	809	88.9	9,971	89.0
Turkish	98	10.8	1,119	10.1
Other	3	0.3	-	
No. of persons engaged in - TOTAL Establishments	13,409	100.0	17,282	100.0
Greek "	12,250	91.4	15,334	88.7
Turkish "	851	6.3	1,948	11.3
Other "	307	2.3	-	-
Gross output £ of -	£		£	
TOTAL Establishments	21,728,365	100.0	7,733,081	100.0
Greek "	20,190,730	92.9	6,859,243	88.7
Turkish "	913,730	4.2	873,838	11.3
Other "	624,238	2.9	-	-

[a]Source: (16).

attributed to this fact, as well as is the fixed size of establishments which, in general, is larger in the Greek sector.* Also a + b = 1 assuming constant return to scale.

In case A below, we assume that Greek labor and Turkish labor are hired exclusively by respectively Greek and Turkish ownership establishments. In case B, we assume complete integration such that the ratio

*In this case the K_G and K_T (number of plants) are not strictly comparable. The difference, however, in $\frac{K_G}{L_G} < \frac{K_T}{L_T}$ is enough to guarantee the inequality sign even if K_G is larger than what has been assumed, 74 percent larger in fact before $\frac{K_G}{L_G} = \frac{K_T}{L_T}$.

of labor to capital (establishments) is the same in both communities. We treat manufacturing establishments as units of capital and persons engaged in manufacturing as units of labor.

We then have:

Case A. (1) a $Y(G) = \varphi L_g^a K_g^b$

where $a = 2/3$ $L_g = 12{,}250$
$b = 1/3$ $K_g = 809$
$\varphi = 1$

(1b) $Y(G) = (12.25)^{2/3}(.809)^{1/3}$

(1c) Log $Y(G)$ = 2/3 log 12,250 + 1/3 log 809 = 3.695

and $Y(G) = 4955.0$ units of output.

Similarly,

(2a) $Y(T) = \varphi L_T^a K_T^b$

where $a = 2/3$ $L_T = 851$
$b = 1/3$ $K_T = 98$
$\varphi = 1$

and

(2b) $Y(T) = 420.7$ units of output

and (2c) $Y(G) + Y(T) = 5375.7$ units of output.

Case B. Factor proportions now are:

$$\frac{K_g}{L_g - X} = \frac{K_T}{L_T + X} \qquad \text{and} \quad X = 565 \text{ (reallocated labor)}$$

(Note: $\frac{K}{L_g} < \frac{K_T}{L_T}$, an approximate indication that there is excess capital (deficient labor) relative to the available labor in the Turkish sector. This may be due to plant indivisibilities as suggested earlier.)

After the labor reallocation, we now have:

$K_g = 809$

$L_g = 11,685$

$K_T = 98$

$L_T = 1,416$

So that

Log Y (G) = 2/3 log 11,685 + 1/3 log 809 = 3.686 units of output

and

Y (G) = 4853 units of output

and similarly

Y (T) = 576.8 units of output

and Y (G) + Y (T) = 5429.8 units of output.

The above results show that under our assumptions, the Turkish sector output in manufacturing increased by 37 percent in case B, the case of complete economic integration. Though Greek output declined slightly (2%) there was a net gain to overall manufacturing output of 1 percent, and thus it is possible under the reallocation to compensate the Greek sector and maintain Pareto optimality while making the Turkish sector better off.

What the above demonstrates and what is expected in view of the theory, is that ethnic considerations, to the extent that they regulate employment on other than economic reasons, result in misallocations.

Thus the objective of economic integration is not inconsistent with economic efficiency and development, and it should be the deliberate objective of economic policy to foster the economic integration of the

two communities. The objective served by such a policy benefits both economic and political objectives, the attainment of which is a sine quoi non to the long run welfare of Cyprus.

Even under conditions where the minimization of the inequality coefficient is at the expense of other economic objectives such as growth, social harmony can be thought of as a more important objective. The objective of policy under such circumstances can most properly be described as lexicographic where, next to some minimum degree of social harmony, every other objective becomes secondary. Increase in aggregate output will be used as an index to measure economic growth only when it contributes also to the economic integration of the ethnic groups on Cyprus.*

*For a similar qualification of aggregate welfare functions in regard to income distribution and population growth, see (50, Ch. 15).

CHAPTER IX. CONCLUSIONS

Economic development theory has not reached the stage of a comprehensive and generally accepted unified theory. The inherent difficulty for such a theory is that development encompasses much more than the subsystem of economics. Economic theory in the West developed as a rationalization of existing economic conditions; economists "observed and reflected on what they saw around them" in the words of Wesley Mitchell. It was not until recently, for instance, that economists became concerned with investment in education as a significant input in society's production function(85). The reason perhaps being that educational development was taking place in the West long before economics came along as an organized social science.

It is now the case with economic development that theory must preceed the process. We are more in need of a theory such as nuclear physics which preceded the nuclear reactor, than of thermodynamics which followed the steam engine.* If economic development theory has not, as yet, provided a comprehensive blueprint for development, the available body of theories is not without insights and ample operational validity.

Faced with such a crucial and urgent social issue as development, the world, the foreign aid specialist, the policy makers, all must make decisions the quality of which depends on the type of information

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*Some of my ideas on this subject I owe to Kenneth Boulding from an Iowa State University lecture, October 13, 1966.

and theoretical understanding furnished. Economic theory must be offering enough of understanding to make a difference in the quality of development policy decisions, in view of the objectives at hand. The increasing employment of professional economists in developing countries testifies to the value placed on economists by decision makers.

Paul Samuelson, appearing before the subcommittee on tax policy some time ago, expressed very clearly the role of the economists in the big issues of policy.(83)

> "The plain truth is this, and it is known to anyone who has looked into the matter: The science of economics does not provide simple answers to complex social problems. It does not validate the view of the man who thinks the world is going to hell, nor the view of his fellow idiot that ours is the best of all possible tax systems.
>
> "I do not wish to be misunderstood. When I assert that economic science cannot give unequivocal answers to the big questions of policy, I do not for a moment imply that economists are useless citizens. Quite the contrary. They would indeed be useless if any sensible man could quickly infer for himself simple answers to the big policy questions of fiscal policy. No need then to feed economists while they make learned studies of the obvious. It is precisely because public policy in the tax and expenditure area is so complex that we find it absolutely indispensable to invest thousands of man-years of scholarly time in scholarly economic research in these areas... What economists do not know about fiscal policy turns out, on simple examination, not to be known by anyone."

There is among economists a general agreement on the important ingredients essential to economic development, such, that we can speak of an aggregate production function the dependent variable of which is output. The inputs to the function can be understood as the set necessary to give the desired rate of growth and of output. Some such inputs are the level of human skills, the level of saving and investment, the stage of technological know-how, the nature of the political system, and the

general institutional framework.

If Q is output, and X_i the inputs, we can write

$$Q = f(x_i, x_2, x_3, \ldots x_n)$$

where a large number of the inputs are non-economic, often referred to as preconditions to growth.*

Economists concentrate on economic inputs (by tradition) with different writers having emphasized one or the other input. Marx emphasized institutional change, Schumpeter the role of the entrepreneur, Lewis, agricultural transformation, etc. It is understood that the importance of the various inputs to the development process varies at different stages of development. The initiation of the development process is debated between balanced and unbalanced growth theories, critical minimum effort, big push and the like.

It is understood that in the case of Cyprus development, economic inputs are of great interest and that a large class of the preconditions to development are satisfied. Some such preconditions are the general level of education, the incentive for change, the adequacy of the civil service, and the general organization of the social order. Certain institutional arrangements remain to be made and should not be overlooked, such as the resolution of the Greek-Turkish conflict, the association with a larger continental unit, political stability and land reform. With this necessary preamble out of the way, the principal findings of

*The terms, growth and development, have been used interchangeably in the course of this study. Strictly speaking we can differentiate the two with "development" implying structural transformation, and "growth" a rise in output over time. Growth is a necessary condition to development, but not the other way around.

this study can be summarized in the form of conclusions.

An eight to ten year planning horizon for Cyprus development should accomplish the following: The gradual disentanglement of the economy from its dependence on the British bases through a simultaneous development of the tourist industry to make up the merchandise deficit resulting from the curtailment of military expenditures. During the same period substantial investment in agriculture and industrial development should take place. More vertical integration of production should be encouraged and import substitution industries, whenever possible, should be developed. The quantitative and consistency implications of this strategy to projected 1970 levels are worked out throughout this study. In the long run, because of the small size of the island, Cyprus development must proceed in international trade, shipping and tourism if not in an outright association with a larger continental unit. The prospects of tourism development appear good and trade can prove another major source of wealth. Before such longer range policies materialize, development policy should be directed toward the internal development of the country so that a certain level of self-sufficiency can maintain a satisfactory living standard even when exogenous sources of income, such as tourism, suddenly disappear. Whatever the long run growth strategy, the rational development of the economy will need to be led by successful progress in agriculture in the immediate future.

The trained economist will detect the theoretical retionale underlying the above strategy. In the short run, the internal structural adjustments necessary for development cannot take place at a rapid enough

rate so that dependence on exports and foreign assistance continue to remain strong. The foreign investment requirements circa 1970 were earlier shown to be close to £ 16-18 mill. In the longer run, adjustments can be made notably in import substitution and agricultural development. The possibilities of domestic development will become progressively more scarce as development proceeds over time and thus the need for trade expansion. On the other hand, one can hardly foresee the revolutionary impact of new technology as, for example, the development of economically feasible water desalinization methods.

The government budget remains the major instrument of government policy to best serve the overall economic objectives of the country. It can be reasonably inferred that economic growth, the balance of payments and the fuller economic integration of the Greek and Turkish communities comprise the major socio-economic objectives of Cyprus.

The objective of economic growth is seen best served by:

a) agricultural development,

b) manufacturing development,

c) tourism and trade.

These are priorities and not the exclusive interest of Cyprus development.

The objective of a more favorable balance of payments can be served by:

a) increased exports,

b) tourism,

c) import substitution,

d) decreased imports.

The objective of Greek-Turkish economic integration implies the development of more economic interdependence between the two groups. From the preliminary findings in Chapter VIII, the more even distribution of income among the two communities appears a first step in conjunction with a political settlement in fostering harmonious relations among the communities in the longer run.

The host of evidence on the Cyprus economy presented suggests that the island will truly prosper not by selling her meager produce but by selling her position. When the Cypriots secceed in demonstrating to the world that they, Greeks, Turks, Armenians, British, can live together in peace and cooperation, Cyprus should seek and become a center of international cooperation in her troubled area. The tense conflict between the neighboring Arabs and Israelis has no apparent end in sight, and the impoverished economic conditions of the area call for the entire array in aid that the international community can give. The ideal of Cyprus becoming a bridge between East and West envisioned by the Republic's president upon his return from exile in 1959 is not a romantic utopian dream, but, in terms of economics, a vital need and a direction of policy long neglected.

The already successful association with the United Nations, in the presence of the United Nations Peace Force for Cyprus, should be extended in peace time. Strong efforts should be made to attract U.N. peace time operations to be based on Cyprus to serve both Arabs and Israelis. The establishment of a genuinely international university is also a good

possibility that must be given careful consideration. Perhaps an extension of the U.N.-Cyprus government operated Agricultural Research Center can take place in the direction of a technical institute moving eventually to a full-fledged university. So that such an institution would be politically acceptable, Greek and Turkish study departments can be included in its curriculum. The recent offers of the Republic's president to make available land and buildings for international scientific retreats is a correct gesture, and efforts must be made to attract the international intellectual community and give continuity to such gatherings. Furthermore, financial and other organizations should be given attractive terms so as to make Cyprus their Middle-Eastern base of operation. A free port, of the Trieste type, can also be developed.

Whatever the policy recommendations, the Cyprus policy maker should continuously be aware of the two fundamental tenants characteristic of the island:

a) the island's small size, and

b) the island's position.

The possibilities for development remain good and the need for development urgent, but before the full economic potential of Cyprus is realized and her constructive role played in the area, she must succeed in solving her own political problems.

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If parents give life and teachers offer a meaningful living, wives make life bearable. It is so at least with my wife, Joy, without whose help this thesis would have taken at least another year before completion.

APPENDIX A

A Linear Programming Formulation

In this appendix, the possibility of maximizing an objective function subject to a model that forms the constraints, is demonstrated. Such a formulation can prove very useful when separate Greek and Turkish behavior equations are incorporated in the model and more inequality constraints are allowed.

Linear programming is, to this date, the most powerful operational technique available to economists. Linear programming (LP) was developed by George B. Dantzig in 1947 and found wide application in economics as expounded by T. C. Koopmans, Earl O. Heady, and others.* The mathematical formulation of LP is simple. It deals with problems in which a linear function is to be extremized (maximized or minimized) subject to a number of constraints which are in the form of linear equalities or inequalities. In matrix notation

$$\text{Max } PX$$

subject to

$$Ax \leq b$$

$$x \geq o$$

The model below is essentially model 36-S with a number of inequality constraints added. Table 32, equation 19 requires manufacturing output to be at least as great as 17 percent of gross domestic product. It should

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*For additional information, see (47, 52, 56, 67).

be remembered from Chapter V that the share of manufacturing to domestic output was less than 13 percent. The "normal" Chenery share of manufacturing called for a 20 to 25 percent level. Construction investment, judged to be too high a share in total investment, is constrained to 8 percent of GNP. Services are required to exceed 20 percent of GNP.

On the basis of the model and the vector of projected values in exogenous variables X_{70}^{3}, gross national product is maximized. The values of the endogenous variables projected to 1970 under the objective function, maximum GNP, subject to the model constraints, are given in Table 33. The level of GNP rises from ₤ 156.44 mill in model 36-S, the non-LP formulation, to ₤ 179.77 mill in the LP formulation.

A general drawback of linear models of this type is the necessity to introduce a large number of boundary constraints some of which are arbitrary in nature (98). In particular, the boundary on $S \leq .08$ GNP, which prevents the explosion of maximum GNP, is rather arbitrary. When the constraint on S was dropped, maximum GNP reached ₤ 193.95 mill, and the balance of payments deficit B became the effective constraint, such that maximum GNP $= f(B)$. This is to be expected since almost all of the supply equations, (sectorial contributions to gross domestic product), incorporate some imported inputs.

The formulation of the econometric model as a linear program (LP) shows that reallocation can attain better results in view of the prescribed objective. The higher level of GNP attained under LP compared to the non-LP formulation of Chapter III, with the same values of exogenous variables, is a clear indication of the optimum reallocation allowed

under linear programming.

The limitations of such formulation at the level of aggregation presented are varied. The particular model given allows only minor flexibility in terms of inequalities. Most of the equations are equalities that do not admit a slack. But even if the model were made more flexible in terms of an enlargement of the feasible set, the main difficulty of the fixidity of coefficients remains. That is, the reorganization of the economy taking place under economic development must be expected to manifest itself in terms of variations in the structural relations which now characterize the economy, rather than in reallocations alone. Such reallocations involving relative factor shares, consuming habits or public policy would be expected to bring about structural changes as well. To allow reallocation while maintaining the constancy of economic relations represented in the equations is, in a sense, self-contradicting, since reallocation under economic development is inevitably tied to structural change.

The above suggests that for further research, a parametric linear programming approach is the appropriate tool for optimization over aggregate econometric models of developing economies. Before such applications become operationally possible, however, we are in need of more refinement in the theory of parametric programming itself. The available body of theory can well handle variations in the coefficients of the objective function (P), or of the constraint vector (b), but not of the entire matrix of coefficients (A)([52]), and that is what structural change essentially entails.

Table 32. The model in linear programming form[a], objective function, max W = 1.0 GNP

1.	Y_A	=	6.340 +	0.117 RA +	0.331 $\overline{RF}_{-1}$	
2.	Y_M	=	6.852 +	0.651 MR +	0.494 $\overline{LTM}_{-1}$	
3.	Y_C	=	3.816 +	0.131 NI_{NA} +	0.244 K_C	
4.	Y_T	=	4.563 +	0.643 M_{VH} +	0.450 $\overline{LT}_{-1}$	
5.	Y_S	=	-9.123 +	0.393 H(		
6.	C_P	=	-1.162 +	0.942 DI		
7.	D	=	1.379 +	0.033 GNP		
8.	M_L	=	-4.650 +	0.146 NI_{NA}		
9.	M_I	=	-16.217 +	0.338 GNP		
10.	M_{DS}	=	17.798 -	0.405 Y_A +	0.218 Y	
11.	M_O	=	-15.261 +	0.298 NI_{NA}		
12.	MR	=	-0.880 +	0.348 M_I		
13.	TB	=	-3.985 +	4.637 C_P		
14.	RA	=	-2.117 +	3.627 M_I		
15.	T_M	=	-0.736 +	0.318 M_C		
16.	T_E	=	0.456 +	0.004 TB		
17.	T_D	=	-1.849 +	0.071 NI		
18.	M_{VH}	=	0.105 +	0.163 M_I		
19.	Y_M	$\geq$	0.17 Y		(manufacturing)	
20.	$T_M + T_E$	$\leq$	0.20 GNP		(indirect taxes)	
21.	T_D	$\leq$	0.10 GNP		(direct taxes)	

[a]For the definition of variables, see Chapter III, p. 39.

Table 32. (Continued)

22.	T_D	$\geq$	0.05 GNP	(direct taxes)
23.	T_M+T_E	$\geq$	0.05 GNP	(indirect taxes)
24.	$-B$	$\geq$	$-\bar{K}$	(balance of payments)
25.	GE	$\leq$	GR	(government budget)
26.	K_C	$\leq$	0.08 GNP	(capital formation in construction)
27.	GI	$\leq$	0.10 GNP	(government investment)
28.	GE	=	$GI + \bar{G}_C$	
29.	Y_{SU}	=	$Y_A + Y_M + Y_C + Y_T + Y_S + T_M + T_E + \bar{Y}_G + \bar{Y}_{MN} - S$	
30.	Y_D	=	$C_P + D + I + \bar{G}_C + (X-M)$	
31.	GR	=	$T_M + T_E + T_D + \bar{T}_O + \bar{T}_{etc.}$	
32.	GNP	=	$Y + \overline{NF}$	
33.	NI	=	$GNP - (T_M + T_E + D) + S$	
34.	NI_{NA}	=	$NI - Y_A$	
35.	DI	=	$NI - .582\ T_D$	
36.	B	=	$M - X$	
37.	X	=	$\bar{X}_A + \bar{X}_T + \bar{X}_{MN} + \bar{X}_O$	
38.	M	=	$M_L + M_I + M_{DS} + M_O$	
39.	M_C	=	$M_L + M_{DS} + M_O$	
40.	I	=	$I_{MP} + \bar{I}_d$	
41.	I_{MP}	=	$0.678\ M_I$	(average 1960-1963)
42.	I	=	$GI + K_C + I_O$	
43.	Y_S	$\geq$	0.20 GNP	
44.	H	=	$Y - Y_S$	
45.	S	$\leq$	0.08 GNP	

Table 33. Activity levels

Name	Activity level	Name	Activity level
Y_A	31.02	M_I	44.55
RA	159.45	M_{DS}	17.40
Y_M	31.17	Y	173.22
MR	14.62	M_O	24.28
Y_C	24.71	TB	680.92
NI_{NA}	132.70	T_M	17.20
K_C	14.38	M_C	56.41
Y_T	21.89	T_E	3.18
M_{VH}	7.37	T_D	9.78
Y_S	42.32	NI	163.72
H	130.90	B	49.79
C_P	147.70	GE	35.86
DI	158.03	GI	17.98
D	7.22	X	51.17
GNP	179.77	M	100.96
M_L	14.72	GR	43.80
I	50.20	I_{MP}	30.20
I_O	17.84	S	11.55

APPENDIX B

Alternative Econometric Models and Forecasts

The main characteristics of the models are repeated in Table 34 for convenience. Models 28, 29, and 32 are given in Tables 35, 36, and 37. Tables 38 and 39 compare actual and forecasted results as given by the different models. It should be noted that for the "true forecast" year, 1964, the forecasts through the models are much superior to mere trend extrapolation.

Table 40 compares the forecasting ability of alternative estimations of three equations for the endogenous variables, Y_A, Y_C, and M_{DS}. Table 41 gives the values of exogenous variables used in the 1970 projections, X_{70}^1, X_{70}^2, and X_{70}^3.

Table 34. Main characteristics of the models presented in this study

Country	- Republic of Cyprus
Type of data	- Yearly data - major reliance on national income accounts
Period covered or used in estimation	- 1951-1963, unless otherwise specified
Method of estimation	- Ordinary least squares (OLS)

Number of stochastic and definitional equations = total equations, exogenous variables		Exogenous variables
Model:		
1. 28 - DY	14 + 14 = 28	20
2. 29 - S	15 + 14 = 29	20

Table 34. (Continued)

3.	32 - S	18 + 14 = 32	16
4.	36 - S (given in Chapter III)	21 + 15 = 36	11

Main institutional, technical and behavioral equations

Model: 36 - DY,S

- 5 - production-supply: agriculture, manufacturing, construction, transportation, services
- 2 - consumption: total private consumption, tobacco
- 1 - capital depreciation
- 4 - import equations: beverages, tobacco and durables, investment and raw material imports, imports with domestic substitutes, other imports (residual)
- 1 - industrial raw materials as a function of imports
- 1 - agricultural raw materials as a function of imports
- 1 - communications investment (vehicles) as a function of imports
- 1 - taxes on imports
- 1 - excise taxes
- 1 - direct taxes

Theil's inequality coefficient (U), a measure of predictive ability of the model and of internal consistency

$$U = \frac{\sqrt{\frac{1}{n}\sum(GNP_{i-F} - GNP_{i-A})^2}}{\sqrt{\frac{1}{n}\sum GNP_{i-F}^2} + \sqrt{\frac{1}{n}\sum GNP_{i-A}^2}}$$

where: GNP_{i-A} = actual GNP at year i

GNP_{i-F} = forecasted GNP, via the model, at year i

		U
1.	27 - DY	.003977
2.	27 - Y	.028414
3.	29 - S^G	.020119
4.	32 - S	.021952
5.	32 - Y_G	.024775
6.	32 - G_C^G	.020518
7.	36 - DY	.018742
8.	36 - S	.018220

Table 35. Model 28 - DY

			DF	R^2	F	D-W
1.	Log Y_A =	0.164 + 0.369 log $\overline{RA}$ + 0.377 log RF_{-1}	10 (51-63)	.71	12.13	1.92
	t	0.634 4.805 2.660				
2.	Y_M =	6.852 + 0.494 $\overline{LTM}_{-1}$ + 0.651 MR	5	.97	70.45	1.47+
	t	8.171 4.476 3.519				
3.	Y_C =	3.816 + 0.131 NI_{NA} + 0.244 $\overline{K}_C$	10	.85	28.41	1.42±
	t	2.231 5.688 4.350				
4.	Y_T =	-0.474 + 0.365 $\overline{LT}$ + 0.074 $\overline{Y}_{-1}$	10 (51-63)	.93	65.87	2.16
	t	-0.282 3.652 3.203				
5.	Y_S =	-9.123 + 0.393 $(Y-Y_S)$	4	.91	40.72	2.66
	t	-1.740 6.381				
6.	C_P =	-1.162 + 0.942 DI	11	.89	98.90	1.83
	t	-0.138 9.945				
7.	D =	1.379 + 0.0325 GNP	4	.97	150.07	3.02
	t	4.607 12.250				
8.	M_L =	-4.650 + 0.146 NI_{NA}	11	.85	61.92	1.52
	t	-3.514 7.869				
9.	M_I =	-16.217 + 0.338 GNP	11	.88	78.0	1.38
	t	-4.143 8.832				

Table 35. (Continued)

			DF	R^2	F	D-W
10.	M_{DS}	$= -7.798 - 0.405\ Y_A + 0.218\ Y$	10	.80	19.59	1.28
	t	-3.325 -2.156 4.850				
11.	M_O	$= -0.349 + 0.181\ \overline{VH}$	11 (51-63)	.91	117.05	1.58
	t	-0.552 10.819				
12.	T_M	$= -0.736 + 0.318\ M_C$	4 (58-63)	.87	27.32	2.21
	t	-0.516 5.226				
13.	T_E	$= -0.070 + 0.00468\ TB + 0.0777\ FL_{-1}$	10 (51-63)	.96	120.36	1.41
	t	-0.515 10.140 2.433				
14.	T_D	$= -1.849 + 0.071\ NI$	7	.54	8.296	
	t	-0.881 2.880				

Definitions:

15. $Y_{Su} = Y_A + Y_M + Y_C + Y_T + Y_S + T_M + T_E + \overline{\hat{Y}}_G + \overline{Y}_{MN} - (\hat{S})$ Supply

16. $Y_D = C_P + D + (\overline{GI} + \overline{K}_C + .24I) + \overline{G}_C + (X-M) + \hat{DY}$ Demand

17. $GNP = Y + \overline{NF}$

18. $NI = GNP - (T_M + T_E + D) + \overline{S}$

19. $NI_{NA} = NI - Y_A$

20. $H = Y - Y_S$

21. $DI = NI - .582\ T_D$ (due to unconventional direct tax structure)

Table 35. (Continued)

22. $X = \bar{X}_A + \bar{X}_T + \bar{X}_{MN} + \bar{X}_O$

23. $M = M_L + M_I + M_{DS} + M_O$

24. $M_C = M_L + M_{DS} + M_O$

25. $B = M - X$

26. $GR = T_M + T_E + T_D + \bar{T}_O + \bar{T}_{etc.}$

27. $GE = \bar{G}_C + \bar{G}_I$

28. $GD = GR - GE$

Table 36. Model 29 - S

			DF	R^2	F	D-W
1.	$\log Y_A$	$= 0.164 + 0.369 \log \overline{RA} + 0.377 \log \overline{RF}_{-1}$	10 (51-63)	.71	12.13	1.92
	t	0.634 4.805 2.660				
2.	Y_M	$= 6.852 + 0.494\ LTM_{-1} + 0.651\ MR$	5	.97	70.45	1.47+
	t	8.171 4.476 3.519				
3.	Y_C	$= 3.816 + 0.131\ NI_{NA} + 0.244\ \bar{K}_C$	10	.85	28.41	1.42+
	t	2.231 5.688 4.350				

Table 36. (Continued)

			DF	R^2	F	D-W
4.	Y_T	$= -0.474 + 0.365\ \overline{LT} + 0.074\ Y_{-1}$	10	.93	65.87	2.16
	t	-0.282 3.652 3.203				
5.	Y_S	$= -9.123 + 0.393\ (Y-Y_S)$	4	.91	40.72	2.66
	t	-1.740 6.381				
6.	C_P	$= -1.162 + 0.942\ DI$	11	.89	98.90	1.83
	t	-0.138 9.945				
7.	D	$= 1.379 + 0.0325\ GNP$	4	.97	150.07	3.02
	t	4.607 12.250				
8.	M_L	$= -4.650 + 0.146\ NI_{NA}$	11	.85	61.92	1.52
	t	-3.514 7.869				
9.	M_I	$= -16.217 + 0.338\ GNP$	11	.88	78.0	1.38
	t	-4.143 8.832				
10.	M_{DS}	$= -7.798 - 0.405\ Y_A + 0.218\ Y$	10	.80	19.59	1.28
	t	-3.325 -2.156 4.850				
11.	M_O	$= -0.349 + 0.181\ \overline{VH}$	11 (51-63)	.91	117.05	1.58
	t	-0.552 10.819				
12.	T_M	$= -0.736 + 0.318\ M_C$	4 (58-63)	.87	27.32	2.21
	t	-0.516 5.226				
13.	T_E	$= -0.070 + 0.00468\ \overline{TB} + 0.0777\ FL_{-1}$	10 (51-63)	.96	120.36	1.41
14.	T_D	$= -1.849 + 0.071\ NI$	7	.54	8.296	
	t	-0.881 2.88				

Table 36. (Continued)

		DF	R^2	F	D-W
15.	$MR = -0.880 + 0.348\ M_I$	6	.73	15.87	1.41
	t -0.469 3.984				

Definitions:

16. $Y_{Su} = \overline{Y}_A + Y_M + Y_C + Y_T + Y_S + T_M + T_E + \hat{\overline{Y}}_G + \overline{Y}_{MN} - (\overline{S})$ Supply

17. $Y_D = C_P + D + (\overline{GI} + \overline{K}_C + .24I) + G_C + (X-M) + \hat{DY}$ Demand

18. $GNP = Y + \overline{NF}$

19. $NI = GNP - (T_M + T_E + D) + \overline{S}$

20. $NI_{NA} = NI - Y_A$

21. $H = Y - Y_S$

22. $DI = NI - .582\ T_D$ (due to unconventional direct tax structure)

23. $X = \overline{X}_A + \overline{X}_T + \overline{X}_{MN} + \overline{X}_O$

24. $M = M_L + M_I + M_{DS} + M_O$

25. $M_C = M_L + M_{DS} + M_O$

26. $B = M - X$

27. $GR = T_M + T_E + T_D + \overline{T}_O + \overline{T}_{etc.}$

Table 36. (Continued)

28. $GE = \overline{G}_C + \overline{G}_I$

29. $GD = GR - GE$

Table 37. Model 32 - S

			DF	R^2	F	D-W
1. Y_A	=	6.340 + 0.117 RA + 0.331 $\overline{RF}_{-1}$	11	.75	16.33	1.99
	t	2.149 5.539 2.507				
2. Y_M	=	6.852 + 0.494 LTM_{-1} + 0.651 MR	5	.97	70.45	1.47+
	t	8.171 4.476 3.519				
3. Y_C	=	3.816 + 0.131 NI_{NA} + 0.244 K_C	10	.85	28.41	1.42±
	t	2.231 5.688 4.350				
4. Y_T	=	4.563 + 0.643 M_{VH} + 0.4498 LT_{-1}	10	.89	41.75	2.55
	t	6.558 3.474 7.671				
5. Y_S	=	-9.123 + 0.393 $(Y-Y_S)$	4	.91	40.72	2.66
	t	-1.740 6.381				
6. C_P	=	-1.162 + 0.942 DI	11	.89	98.90	1.83
	t	-0.138 9.945				
7. TB	=	-3.985 + 4.637 C_P	11	.60	16.60	2.04
	t	-0.042 4.075				

Table 37. (Continued)

			DF	R^2	F	D-W
8.	D	= 1.379 + 0.0325 GNP	4	.97	150.07	3.02
		t 4.607 12.250				
9.	M_L	= -4.650 + 0.146 NI_{NA}	11	.85	61.92	1.52
		t -3.514 7.869				
10.	M_I	= -16.217 + 0.338 GNP	11	.88	78.0	1.38
		t -4.143 8.832				
11.	M_{DS}	= -7.798 - 0.405 Y_A + 0.218 Y	10	.80	19.59	1.28
		t -3.325 -2.156 4.850				
12.	M_O	= -15.261 + 0.298 NI_{NA}	11	.79	42.37	1.13
		t -4.677 6.509				
13.	MR	= -0.880 + 0.348 M_I	6	.73	15.87	1.41
		t -0.469 3.984				
14.	RA	= -2.117 + 3.627 M_I	12	.81	15.18	
		t -0.230 7.154				
15.	M_{VH}	= 0.105 + 0.163 M_I	11	.62	17.82	
		t 0.142 4.221				
16.	T_M	= -0.736 + 0.318 M_C	4	.87	27.32	2.21
		t -0.516 5.226				
17.	T_E	= 0.456 + 0.0047 TB	4 (58-63)	.92	45.34	2.56
		t 1.677 6.733				
18.	T_D	= -1.849 + 0.071 NI	7	.54	8.296	
		t -0.881 2.88				

Table 37. (Continued)

Definitions:

19. $Y_{Su} = \bar{Y}_A + Y_M + Y_C + Y_T + Y_S + T_M + T_E + \bar{\hat{Y}}_G + \bar{Y}_{MN} - (\hat{S})$ Supply

20. $Y_D = C_P + D + (\overline{GI} + \bar{K}_C + .24I) + G_C + (X-M)$ Demand

21. GNP $Y + \overline{NF}$

22. NI $= GNP - (T_M + T_E + D) + \hat{S}$

23. $NI_{NA} = NI - Y_A$

24. DI $= NI - .582\ T_D$ (due to unconventional direct tax structure)

25. H $= Y - Y_S$

26. X $= \bar{X}_A + \bar{X}_T + \bar{X}_{MN} + \bar{X}_O$

27. M $= M_L + M_I + M_{DS} + M_O$

28. $M_C = M_L + \ldots + M_{DS} + M_O$

29. B $= M - X$

30. GR $= T_M + T_E + T_D + \bar{T}_O + \bar{T}_{etc.}$

31. GE $= \bar{G}_C + \bar{G}_I$

32. GD $= GR - GE$

Table 38. Actual and forecasted GNP[a]

Model	U	1959		1960		1963		Actual Forecast 1964	
		F[b]	A[c]	F	A	F	A	F	A
27-DY	.004	106.2	105.8	103.2	104.6	126.7	127.7	116.9	116.5
28-Y_G	.028	116.2	"	109.7	"	130.0	"	122.6	"
29-S	.020	113.0	"	107.9	"	128.9	"	121.3	"
32-S	.022	113.6	"	108.6	"	128.0	"	121.7	"
32-Y_G	.025	114.2	"	108.9	"	128.5	"	123.1	"
32-G_C	.020	108.9	"	105.9	"	123.4	"	109.0	"
36-S	.018	110.2	"	104.1	"	121.1	"	118.9	"
36-DY	.019	113.3	"	107.9	"	126.4	"	114.2	"

[a]Model variations 28-Y_G, 32-Y_G, 32-G_C, 36-DY only differ in the choice of slack variable from the corresponding equal number equation models given.

[b]Forecasted values.

[c]Actual values.

Table 39. Forecasted and actual values of endogenous variables

Model	1959		1960		1963		Actual Forecast 1964	
	F	A	F	A	F	A	F	A
32-G_C								
Y_A	19.87	19.7	19.11	18.2	23.37	24.5	20.34	23.3
Y_M	13.39	12.9	13.98	13.6	16.38	16.6	14.95	17.1
Y_C	15.93	14.6	15.57	14.3	18.53	20.1	15.81	16.4
Y_T	10.52	10.6	10.06	10.4	12.86	13.0	13.18	11.7
Y_S	23.94	22.0	22.35	22.5	27.11	28.2	23.93	25.1

Table 39. (Continued)

Model	1959		1960		1963		Actual Forecast 1964		
	F	A	F	A	F	A	F	A	
C_P	86.30	80.9	84.34	87.0	98.16	103.7	87.08	88.7	
GNP	108.87	105.8	105.86	104.6	123.42	127.7	108.99	116.5	
M	42.07	42.7	39.51	41.4	52.30	52.9	41.31	44.3	
GR	28.26	27.60	24.38	25.13	26.33	26.42	18.43	-	a
T_M	6.10	7.0	5.60	7.0	7.78	7.8	5.84	-	
T_E	2.32	2.2	2.28	1.7	2.58	2.4	2.33	-	
G_C	14.92	-	8.02	-	16.92	-	-1.38	-	
32-Y_G									
Y_A	20.62	19.7	19.54	18.2	24.10	24.5	22.36	23.3	
Y_M	13.80	12.9	14.22	13.6	16.77	16.6	16.04	17.1	
Y_C	16.39	14.6	15.84	14.3	18.98	20.1	17.04	16.4	
Y_T	10.72	10.6	10.17	10.4	13.05	13.0	13.68	11.7	
Y_S	25.44	22.0	23.23	22.5	28.56	28.2	26.92	25.1	
C_P	90.18	80.9	86.59	87.0	101.90	103.7	97.39	88.7	
GNP	114.18	105.8	108.94	104.6	128.53	127.7	123.13	116.5	
M	46.28	42.7	41.96	41.4	56.36	52.9	52.52	44.3	
GR	29.42	27.60	25.04	25.13	27.74	26.42	21.50	-	
T_M	6.86	7.0	6.05	7.0	8.52	7.8	7.88	-	
T_E	2.40	2.2	2.32	1.7	2.65	2.4	2.56	-	
Y_G	9.85	-	6.72	-	6.69	-	8.13	-	
28-DY									
Y_M	13.52	12.9	13.60	13.6	16.81	16.6	14.91	17.1	b
Y_C	15.72	14.6	15.39	14.3	18.77	20.1	16.26	16.4	
Y_T	9.70	10.6	9.87	10.4	13.25	13.0	14.29	11.7	b
Y_S	23.19	21.62	21.73	22.5	28.03	28.2	25.16	25.1	
C_P	85.10	80.9	83.24	87.0	101.30	103.37	92.91	88.7	

Table 39. (Continued)

Model	1959		1960		1963		Actual Forecast 1964	
	F	A	F	A	F	A	F	A
GNP	116.23	105.8	109.67	104.6	129.98	127.4	122.45	116.5
M	46.98	42.7	42.88	41.4	56.93	52.9	53.00	44.3
GR	28.66	27.60	24.09	25.13	26.83	26.42	21.04	-
T_M	6.87	7.0	6.27	7.0	8.55	7.8	8.10	-
T_E	1.43	2.2	1.02	1.7	1.86	2.4	1.89	- [b]
Y_A	20.09	19.7	19.28	18.2	24.95	24.5	23.30	23.3 [b]
28-Y_G								
Y_M	13.52	12.9	13.60	13.6	16.81	16.6	14.91	17.1 [b]
Y_C	16.85	14.6	16.11	14.3	19.15	20.1	16.90	16.4
Y_T	9.70	10.6	9.87	10.4	13.24	13.0	14.29	11.7 [b]
Y_S	26.01	22.0	23.43	22.5	28.96	28.2	26.76	25.1
C_P	92.86	80.9	88.22	87.0	103.86	103.7	97.31	88.7
GNP	116.23	105.8	109.67	104.6	129.98	127.4	122.56	116.5
M	46.98	42.7	42.88	41.4	56.93	52.9	53.00	44.3
GR	28.66	27.60	24.09	25.13	26.83	26.42	21.04	-
T_M	6.87	7.0	6.27	7.0	8.55	7.8	8.10	-
T_E	1.43	2.2	1.02	1.7	1.86	2.4	1.89	- [b]
Y_A	20.09	19.7	19.28	18.2	24.95	24.5	23.30	23.3 [b]
29-S								
Y_A	20.09	19.7	19.28	18.2	24.95	24.5	23.30	23.3
Y_M	13.71	12.9	14.14	13.6	16.80	16.6	15.91	17.1
Y_C	16.01	14.6	15.64	14.3	18.86	20.1	16.58	16.4
Y_T	9.70	10.6	9.87	10.4	13.25	13.0	14.29	11.7
Y_S	25.16	22.0	22.93	22.5	28.65	28.2	26.41	25.1

Table 39. (Continued)

Model	1959		1960		1963		Actual Forecast 1964	
	F	A	F	A	F	A	F	A
C_P	86.06	80.9	84.99	87.0	101.85	103.7	95.10	88.7
GNP	113.04	105.8	107.90	104.6	128.87	127.7	121.34	116.5
M	44.27	42.7	41.37	41.6	55.99	52.9	51.97	44.3
GR	27.69	27.6	23.55	25.13	26.50	26.42	20.68	-
T_M	6.34	7.0	5.98	7.0	8.37	7.8	7.90	-
T_E	1.43	2.2	1.02	1.7	1.86	2.4	1.89[b]	-
32-S								
Y_A	20.55	19.7	19.50	18.2	24.03	24.5	22.16	23.3
Y_M	13.76	12.9	14.20	13.6	16.73	16.6	15.94	17.1
Y_C	16.19	14.6	15.72	14.3	18.79	20.1	16.50	16.4
Y_T	10.70	10.6	10.16	10.4	13.03	13.0	13.64	11.7
Y_S	25.29	22.0	23.14	22.5	28.41	28.2	26.52	25.1
C_P	88.73	80.9	85.75	87.0	100.50	103.7	93.52	88.7
GNP	113.52	105.8	108.67	104.6	128.05	127.7	121.75	116.5
M	45.34	42.7	41.41	41.4	55.45	52.9	50.01	44.3
GR	29.03	27.60	24.82	25.13	27.07	26.42	20.47	-
T_M	6.62	7.0	5.91	7.0	8.29	7.8	7.24	-
T_E	2.37	2.2	2.30	1.7	2.63	2.4	2.47	-

[a] "-" indicates that information was not available.

[b] Zero order variables (explanatory variables exogenous).

Table 40. Forecasting ability of alternative equation forms

		U	DF
Given:			
1.	$Y_{A1} = 6.500 + 0.121\ RA + 0.311\ RF_{-1}$	$U_{A1} = .0269$	14
	$Y_{A2} = 6.340 + 0.117\ RA + 0.331\ RF_{-1}$	$U_{A2} = .0269$	11
	$\text{Log}_{10}Y_{A3} = 0.164 + 0.370\ \text{Log}_{10}RA + 0.377\ \text{Log}_{10}RF_{-1}$	$U_{A3} = .0242$	
2.	$Y_{C1} = 3.816 + 0.131\ NI_{NA} + 0.244\ K_C$	$U_{C1} = .0302$	10
	$Y_{C2} = 2.763 + 0.139\ NI_{NA} + 0.280\ K_C$	$U_{C2} = .0253$	14
3.	$M_{DS1} = -7.798 - 0.405\ Y_A + 0.218\ Y$	$U_{DS1} = .0996$	10
	$M_{DS2} = -8.637 - 0.601\ Y_A + 0.287\ Y$	$U_{DS} = .1680$	14

	1959	1960	1963	1964
Forecasted values				
RA	76.9	72.0	105.0	83.90
RF_{-1}	15.22	14.23	19.50	16.59
$\text{Log}_{10}RA$	1.8859	1.8573	2.0212	1.9238
$\text{Log}_{10}RF_{-1}$	1.1824	1.1532	1.2900	1.2199
NI_{NA}	72.5	73.6	87.9	79.4
K_C	8.90	8.20	14.40	8.20
Y_A	19.7	18.2	24.5	23.3
Y	105.0	101.2	123.3	112.0

Table 40. (Continued)

	1959	1960	1963	1964
Actual values				
Y_A	19.7	18.2	24.5	23.3
Y_C	14.6	14.3	20.1	16.4
M_{DS}	8.71	7.64	7.12	-

Table 41. Exogenous variables

	X_{59}	X_{60}	X_{63}	X_{64}	X_{70}^1	X_{70}^2	X_{70}^3
MR	6.48	5.35	8.66	6.22	42.70	35.00	51.00
LTM_{-1}	4.96	6.62	8.75	8.11	26.26	26.26	26.26
K_C	8.90	8.20	14.40	8.20	15.15	17.33	20.15
LT	7.52	7.04	14.21	15.35	32.10	32.10	32.10
Y_{-1}	100.30	105.00	115.30	123.70	163.84	163.84	187.82
Y_A	20.09	19.28	24.95	23.30	34.95	41.12	51.30
VH	41.89	44.18	63.56	65.95	133.08	175.92	175.92
TB	386.30	305.50	489.80	499.00	785.21	785.21	785.21
FL_{-1}	4.09	3.76	3.48	3.30	4.74	5.53	8.02
Y_G	8.40	6.10	5.60	5.10	6.88	8.02	8.02
Y_{MN}	7.80	7.80	6.30	4.70	6.40	6.93	9.46
S	0.20	0.40	1.20	0.70	2.02	2.35	2.94
GI	2.60	2.80	5.10	3.90	10.46	14.68	18.04
I	16.60	14.50	24.00	14.90	23.95	32.61	47.31
G_C	20.40	11.20	12.20	13.20	17.88	20.79	20.79
NF	0.80	3.20	4.10	4.50	6.55	7.61	7.61
X_A	7.43	6.99	10.79	9.70	14.64	19.23	19.23
X_{MN}	10.48	11.02	8.59	7.75	8.64	9.36	12.77

Table 41. (Continued)

	X_{59}	X_{60}	X_{63}	X_{64}	X_{70}^{1}	X_{70}^{2}	X_{70}^{3}
X_T	1.40	1.80	4.30	0.96	7.44	10.61	14.92
X_0	9.20	10.50	12.20	21.10	20.45	25.52	28.22
T_0	9.10	7.60	6.90	4.85	8.91	10.19	11.86
$T_{etc.}$	5.80	4.10	3.19	0.39	4.73	5.50	9.79
RF_{-1}	15.22	14.23	19.50	16.59	18.20	18.20	18.20
LTM_{-1}	4.96	6.62	8.75	8.11	26.26	26.26	26.26
LT_{-1}	8.32	7.52	12.37	14.21	28.00	28.00	28.00

APPENDIX C

Data: Concepts and Tables

The data used in the estimation of the econometric models presented are based on numerous publications of the Cyprus government. The major source of national income account data is the publication of the Department of Statistics and Research presently entitled Economic Report. In addition the publication Statistical Abstract proved very useful for more detailed and varied information on Cyprus. Both of these publications are annual.

The first official national income estimates were made in 1951. That estimate was based mainly upon data from the 1950 Census of Employment and Production, and the 1950 Census of Agriculture. Since 1955, estimates have been made annually by the Department of Statistics and Research of the Ministry of Finance which were published in the Economic Review. With the 1963 revision, similar information is found in the Economic Report.*

A list of important sources of data used in this thesis are given in the bibliographical reference (12 - 44).

Concepts and classification of data are, in principle, those of the United Nations system. The National Income Accounts were revised in 1963 and the revision carried back only to 1958.

The quality of the available data is a major concern to the researcher interested in statistical inference and economic analysis leading

*For more information on accounting practices, see (99).

to policy recommendations. The Cyprus data are relatively good due to the small size of the island and the good work done by the Department of Statistics and Research in recent years. The small size of the island and the high degree of openess, discussed earlier, have a positive by-product when it comes to the quality of statistical data. The export-import statistics are of the census type accounting for the entire population and are well kept because of their importance for government revenue. Export-import statistics, in turn, form the basis for the estimation of other economic variables (i.e. investment).

The good quality of available data did not prevent a number of serious difficulties in the progress of this study. These difficulties were mainly the following:

a. the possible non-correspondence between the data available and its theoretical counterpart,

b. the Cyprus national income accounts were thoroughly revised in 1963, but the revision went back only to 1958 giving too short a period for adequate time series estimation, unless old and new series were reconciled,

c. the national income account data for the 1950-1954 period are only estimates based on the 1950 census,

d. lack of disaggregated data especially in consumption prevented construction of more adequate models.*

An example of how old and new series were reconciled is given in Table 42. Essentially the average discrepancy factor for 1958 and 1959 between the old and new series was used to "up-date" the old series back to 1950. A price adjustment is also made to express all variables, unless otherwise stated to 1958 constant prices. The data used for the relevant

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*For some general suggestions on data gathering in a developing economy, see (2).

variables is not always consistent with data given by the National Income Accounts presented in the Economic Report. The discrepancy is due mainly to the rounding errors and to the aggregation of some variables or the disaggregation of others. In some cases, such as in direct taxes, a number of minor items were excluded from the data used in the estimation of the models. Examples of difficulties encountered with data follow.

The total exports of goods and services in constant prices were inconsistent with sectorial exports for a number of years. That is, the parts did not always add up to the total, and worse yet, exceeded the total for the years 1951 to 1955. The National Income Account export-import figures differ from the balance of payments accounts by the item, net factor payments from abroad. Net factor payments are listed separately so as to give the Gross National Product when added to Gross Domestic Product. There is no reason why the sectorial output of merchandise exports should not be the same in both the National Income and Balance of Payments accounts when allowance is made for net factor payments. The discrepancy centers on the years prior to 1958 where adjustments had to be made in reconciling old and new series. This suggests that errors introduced in the reconciliation of the series caused the discrepancy. Such discrepancies were many and varied.

Difficulties with data are a usual part of econometric work. More time was invested in data gathering, reconciling and correcting than for any other facet of this study. It is heartening that in spite of all the data limitations and difficulties encountered and the many compromises which had to be made if work was to proceed, not to mention any of the

estimation problems, the results obtained are adequate and useful from the prediction and policy standpoint. The following tables (43-51) give the data used in estimating the stochastic equations of the several models.

Table 42. Reconciliation of old and new series

	Price Index	Old		a	New		1958 Price Index
		Current	Constant		Current	Constant	
1950	1.00	5.9	5.9	1.342	7.9	9.6	.826
1951	1.08	6.4	5.9	1.342	8.6	9.6	.893
1952	1.08	6.5	6.0	1.342	8.7	9.7	.893
1953	1.09	7.0	6.4	1.342	9.4	10.4	.901
1954	1.06	6.8	6.4	1.342	9.1	10.4	.876
1955	1.18	7.7	6.5	1.342	10.3	10.6	.975
1956	1.22	8.3	6.8	1.342	11.1	11.0	1.008
1957	1.23	8.6	7.0	1.342	11.5	11.3	1.017
1958	1.21	8.0	6.6	1.338	10.7	10.7	1.000
1959		8.4	6.9	1.345	11.3	11.3	
1960					11.8	11.8	
1961					13.0	13.4	
1962					13.4	13.8	
1963					14.4	14.3	

Table.43. Data 1950 - 1963

	C_P	t	I	I_{-1}	GI_{-58}	GNP	M_{DS}	Y_A	Y_{M-1}	Y	M_I	M_L
1950	56.3	0	8.9	8.5	2.5	74.6	2.29	15.2	9.6	69.2	7.44	2.70
1951	63.2	1	10.0	8.9	2.0	75.2	3.11	13.5	9.8	70.9	10.04	3.44
1952	68.9	2	11.0	10.0	2.3	83.4	3.13	16.3	9.8	78.4	9.70	3.48
1953	77.2	3	13.6	11.0	2.9	90.9	3.84	21.1	9.9	85.6	11.88	3.96
1954	72.2	4	21.1	13.6	3.5	91.9	4.17	19.1	10.6	87.0	14.50	4.56
1955	76.9	5	25.1	21.1	3.3	93.4	5.25	18.2	10.9	88.8	17.80	5.12
1956	89.7	6	26.5	25.1	4.0	98.5	9.44	19.7	11.3	97.7	20.59	6.08
1957	88.3	7	28.6	26.5	4.1	110.4	8.31	20.3	12.0	102.4	22.00	7.12
1958	74.2	8	16.7	28.6	3.2	102.4	7.38	17.9	12.6	93.1	17.34	5.84
1959	80.9	9	17.9	16.7	2.6	105.8	8.71	19.7	12.2	96.3	20.03	6.66
1960	87.0	10	14.1	17.9	2.8	104.6	7.64	18.2	12.9	93.1	17.60	6.35
1961	93.4	11	17.7	14.1	3.7	114.6	7.45	23.4	13.6	102.9	21.80	5.62
1962	96.7	12	24.1	17.7	5.8	120.0	8.22	23.9	15.4	107.4	25.90	6.68
1963	103.7	13	24.4	24.1	5.1	127.4	7.12	24.5	15.9	113.8	25.12	8.84

Table 43. (Continued)

	NI_{NA}	T_D	Y_{MN}	T_E	VH	TB	T_O	NI	X_A	P_{Food-1}
1950	54.2	1.19	5.7	0.87	9.970	246.1	1198	69.4	5.33	63.0
1951	54.8	2.01	6.0	1.00	11.305	279.6	1.85	68.3	7.10	64.3
1952	59.7	2.84	6.8	1.08	12.960	302.7	1.66	76.0	8.19	74.1
1953	61.2	3.36	5.4	1.20	15.310	324.5	2.04	82.3	7.33	79.3
1954	62.0	2.82	6.2	1.32	18.369	340.5	2.90	81.1	6.99	81.6
1955	64.7	3.24	5.7	1.42	23.473	350.0	2.50	82.9	7.20	82.4
1956	68.9	4.47	7.1	1.60	29.037	370.6	4.23	88.6	5.80	87.3
1957	77.6	5.60	7.5	1.52	34.543	331.1	8.44	97.9	7.22	96.0
1958	72.6	4.45	7.6	2.16	36.950	423.9	10.00	90.5	6.40	101.3
1959	72.5	3.60	7.8	2.22	41.888	386.3	10.00	92.2	7.43	105.0
1960	73.6	4.31	7.8	1.80	44.180	305.5	8.56	91.8	6.99	104.5
1961	78.8	3.40	6.8	2.52	51.267	477.5	7.00	102.2	6.87	106.8
1962	82.9	3.80	6.1	2.61	57.700	485.9	6.48	106.8	9.25	104.5
1963	87.9	4.00	6.3	2.50	63.559	489.8	7.42	112.4	10.79	104.2

Table 43. (Continued)

	UK_F	Y_{A-1}	UK_{F-1}	$\frac{P_{XA}}{P_{Food}}$	P_{XA-1}	X_{MN}	P_{MN-1}	RA	RF_{-1}	Y_M	EC
1950	4.94	15.0	4.90	117.2	103.0	7.85	135.0	29.4	15.00	9.8	3.2
1951	4.91	15.2	4.94	104.9	106.0	9.52	136.0	36.6	13.28	9.8	4.1
1952	4.86	13.5	4.91	100.5	109.0	10.08	154.0	32.4	23.54	9.9	5.0
1953	5.07	16.3	4.86	100.7	112.0	7.29	172.0	40.1	21.92	10.6	7.1
1954	5.17	21.1	5.07	101.4	115.7	8.66	189.8	43.7	18.28	10.9	12.8
1955	5.30	19.1	5.17	101.0	117.1	8.50	193.3	37.2	23.97	11.3	18.8
1956	5.38	18.2	5.30	117.5	123.9	9.92	212.8	69.8	16.42	12.0	30.4
1957	5.47	19.7	5.38	88.0	158.5	9.81	239.2	70.2	16.13	12.6	43.6
1958	5.49	20.3	5.47	100.0	124.7	9.69	187.0	69.1	17.88	12.2	46.5
1959	5.65	17.9	5.49	89.8	147.6	10.48	159.3	76.9	15.22	12.9	44.0
1960	5.80	19.7	5.65	89.0	131.8	11.02	158.0	72.0	14.23	13.6	53.3
1961	5.95	18.2	5.80	96.8	133.4	9.25	155.1	82.2	13.45	15.4	57.0
1962	6.00	23.4	5.95	107.0	142.3	8.09	158.2	82.5	22.31	15.9	60.0
1963	6.08	23.9	6.00	99.7	157.0	8.59	165.4	105.0	19.50	16.6	68.8

Table 43. (Continued)

	K_M	GI	Y_S	Y_T	L_T	Y_{-1}	Y_C	K_C	L_C
1950	2.0	1.54	18.5	4.2	3.45	68.0	12.5	7.0	8.8
1951	2.1	1.40	19.9	5.4	3.76	69.2	13.1	7.9	10.5
1952	2.2	1.70	20.8	6.9	4.32	70.9	14.4	8.7	12.2
1953	2.6	2.21	21.8	7.7	5.15	78.4	15.4	10.7	13.9
1954	4.0	2.75	22.4	8.9	5.95	85.6	15.5	17.6	15.6
1955	5.2	2.74	23.5	9.2	7.15	87.0	16.4	17.4	17.1
1956	6.1	3.60	25.2	9.7	8.06	88.8	17.2	18.9	18.6
1957	6.5	3.92	24.3	10.5	8.04	97.7	17.9	16.5	20.0
1958	5.5	3.16	21.4	9.8	8.32	102.4	16.5	11.4	20.0
1959	5.6	2.69	22.3	10.6	7.52	93.1	14.6	8.9	19.0
1960	4.5	2.86	22.7	10.4	7.04	96.3	14.3	8.2	20.4
1961	4.5	3.81	24.6	11.5	11.48	93.1	16.1	9.4	20.6
1962	6.7	5.96	26.6	12.1	12.37	102.9	17.2	11.4	20.8
1963	6.5	5.37	27.7	13.0	14.21	107.4	20.1	14.4	21.5

Table 44. Data 1951 - 1963

	C_P	DI	$NI-T_D$	NI	GNP	I	I_{-1}	G_E	t	M_I	GI_{-58}
1951	61.0	66.6	65.4	68.3	75.2	10.0	8.9	1.0	1	10.04	2.0
1952	66.4	73.7	72.1	76.0	83.4	11.0	10.0	1.0	2	9.70	2.3
1953	76.2	79.7	77.8	82.3	90.9	13.6	11.0	1.0	3	11.88	2.9
1954	72.6	79.0	77.5	81.1	91.9	21.1	13.6	1.0	4	14.50	3.5
1955	76.0	80.6	79.0	82.9	93.4	25.1	21.1	1.0	5	17.80	3.3
1956	88.2	85.7	83.6	88.6	98.5	26.5	25.1	3.6	6	20.59	4.0
1957	84.7	94.5	92.1	97.9	110.4	28.6	27.0	8.4	7	22.00	4.1
1958	74.2	87.9	86.1	90.5	102.4	16.7	28.6	10.5	8	17.34	3.2
1959	80.9	90.2	88.7	92.2	105.8	17.9	16.7	9.6	9	20.03	2.6
1960	87.0	89.3	87.2	91.8	104.6	14.1	17.9	1.0	10	17.60	2.8
1961	93.4	99.0	97.1	102.2	114.6	17.7	14.1	1.0	11	21.80	3.7
1962	96.7	103.5	101.5	106.8	120.0	24.1	17.7	1.0	12	25.90	5.8
1963	103.7	108.8	106.8	112.4	127.4	24.4	24.1	1.0	13	25.12	5.1

Table 44. (Continued)

	M_{DS}	Y_A	M_L	Y	NI_{NA}	M_O	VH	VH_{-1}	T_D	T_E	TB
1951	3.11	13.5	3.44	76.6	54.8	2.1	11.30	9.97	2.9	1.4	279.5
1952	3.13	16.3	3.48	85.4	59.7	2.8	12.96	11.30	3.9	1.5	302.7
1953	3.84	21.1	3.96	91.6	61.2	2.7	15.31	12.96	4.5	1.6	324.5
1954	4.17	19.1	4.56	92.2	62.0	3.3	18.37	15.31	3.6	1.7	340.5
1955	5.25	18.2	5.12	96.3	64.7	2.6	23.47	18.37	3.9	1.7	350.0
1956	7.44	19.7	6.08	105.3	68.9	3.7	29.04	23.47	5.0	1.8	370.6
1957	8.31	20.3	7.12	113.7	77.6	4.8	34.54	22.04	5.8	1.6	331.1
1958	7.38	17.9	5.84	100.3	72.6	6.5	36.95	34.54	4.4	2.2	423.9
1959	8.71	19.7	6.66	105.0	72.5	7.3	41.89	36.95	3.5	2.2	386.3
1960	7.64	18.2	6.35	101.2	73.6	9.8	44.18	41.89	4.6	1.7	305.5
1961	7.45	23.4	5.62	110.1	78.8	8.5	51.27	44.18	5.1	2.5	477.5
1962	8.22	23.9	6.68	115.3	82.9	9.4	57.70	51.27	5.3	2.6	485.9
1963	7.12	24.5	8.84	123.3	87.9	11.8	63.56	57.70	5.6	2.4	489.8

Table 44. (Continued)

	FL_{-58}	T_M	M_C	X_A	X_{MN}	Y_{MN}	RA	RF_{-1}	$Log_{10}Y_A$	$Log_{10}RA$
1951	1.71	3.4	8.7	7.10	9.52	6.0	36.6	13.28	1.13033	1.56348
1952	1.75	3.7	9.4	8.19	10.08	6.8	32.4	23.54	1.21219	1.51055
1953	1.83	4.0	10.5	7.33	7.29	5.4	40.1	21.92	1.32428	1.60314
1954	2.21	4.5	12.0	6.99	8.66	6.2	43.7	18.28	1.28103	1.64048
1955	2.44	5.3	13.0	7.20	8.50	5.7	37.2	23.97	1.26007	1.57054
1956	3.73	5.3	19.2	5.80	9.92	7.1	69.8	16.42	1.29447	1.84386
1957	4.28	7.1	20.2	7.22	9.81	7.5	70.2	16.13	1.30750	1.84634
1958	4.09	5.2	19.8	6.40	9.69	7.6	69.1	17.88	1.25285	1.83948
1959	3.76	7.0	22.7	7.43	10.48	7.8	76.9	15.22	1.29447	1.88593
1960	4.06	7.0	23.8	6.99	11.02	7.8	72.0	14.23	1.26007	1.85733
1961	3.86	6.0	21.6	6.87	9.25	6.8	82.2	13.45	1.36922	1.91487
1962	3.48	7.1	24.3	9.25	8.09	6.1	82.5	22.31	1.37840	1.91645
1963	3.87	7.8	27.8	10.79	8.59	6.3	105.0	19.50	1.38917	2.02119

Table 44. (Continued)

	$Log_{10}RF_{-1}$	RF	RA_{-1}	Y_M	LB_{-1}	Y_S	Y_T	L_T	Y_{-1}	Y_C
1951	1.12320	23.54	29.4	9.8	9.21	21.6	5.4	3.76	72.8	13.1
1952	1.37181	21.92	36.6	9.9	10.19	22.8	6.9	4.32	76.6	14.4
1953	1.34084	18.28	32.4	10.6	10.50	22.5	7.7	5.15	85.4	15.4
1954	1.26198	23.97	40.1	10.9	12.30	21.8	8.9	5.95	91.6	15.5
1955	1.37967	16.42	43.7	11.3	13.32	24.5	9.2	7.15	92.2	16.4
1956	1.21537	16.13	37.2	12.0	14.89	25.4	9.7	8.06	96.3	17.2
1957	1.20763	17.88	69.8	12.6	14.90	27.8	10.5	8.04	105.3	17.9
1958	1.25993	15.22	70.2	12.2	21.22	21.8	9.8	8.32	113.7	16.5
1959	1.18241	14.23	69.1	12.9	22.30	22.0	10.6	7.52	100.3	14.6
1960	1.15320	13.45	76.9	13.6	28.33	22.5	10.4	7.04	105.0	14.3
1961	1.12872	22.31	72.0	15.4	32.25	24.6	11.5	11.48	101.2	16.1
1962	1.34850	19.50	82.2	15.9	36.31	26.4	12.1	12.37	110.1	17.2
1963	1.29003	16.59	82.5	16.6	40.65	28.2	13.0	14.21	115.3	20.1

Table 44. (Continued)

	K_{C-58}	KC_{-1}	L_{MN}	P_{MN-1}	Y_{MN-1}	$\sum K+K_{-1}$	FL_{-1}
1951	7.9	7.0	6.44	136.0	7.85	0.9	1.65
1952	8.7	7.9	6.58	154.0	9.52	0.9	1.71
1953	10.7	8.7	6.64	172.0	10.08	0.9	1.75
1954	17.6	10.7	6.72	189.8	7.29	0.9	1.83
1955	17.4	17.6	7.08	193.3	8.66	1.0	2.21
1956	18.9	17.4	6.68	212.8	8.50	1.3	2.44
1957	16.5	18.9	5.95	239.2	9.92	1.5	3.73
1958	11.4	16.5	5.53	187.0	9.81	1.4	4.28
1959	8.9	11.4	4.90	159.3	9.69	1.2	4.09
1960	8.2	8.9	5.17	158.0	10.48	1.0	3.76
1961	9.4	8.2	5.36	155.1	11.02	1.2	4.06
1962	11.4	9.4	5.37	158.2	9.25	1.9	3.86
1963	14.4	11.4	5.21	165.4	8.09	2.4	3.48

Table 45. Data 1956 - 1963

	C_P	$NI-.582T_D + S_{pg}$	T_E	FL_{-1}	TB_{okes}	Y_M	LTM_{-1}	M_{IR-58}	Y_S	$LWR_{current}$
1956	88.2	86.3	1.8	2.44	370.6	12.0	2.79	5.28	25.4	5.10
1957	84.7	95.1	1.6	3.73	331.1	12.6	3.34	6.25	27.8	7.48
1958	74.2	88.5	2.2	4.28	423.9	12.2	4.30	5.18	21.8	7.38
1959	80.9	92.0	2.2	4.09	386.3	12.9	4.96	6.48	22.0	9.67
1960	87.0	91.5	1.7	3.76	305.5	13.6	6.62	5.35	22.5	10.41
1961	93.4	99.8	2.5	4.06	477.5	15.4	6.80	7.51	24.6	10.92
1962	96.7	104.5	2.6	3.86	485.9	15.9	7.68	7.52	26.4	12.51
1963	103.7	110.0	2.4	3.48	489.8	16.6	8.75	8.66	28.2	16.59

Table 46. Data 1958 - 1963

	C_P	NI	T_E	TB	T_M	M_C	X_O	GNP	X_T	G_{T-1}
1958	74.2	90.5	2.2	423.9	5.2	19.8	9.0	102.4	0.8	181.0
1959	80.9	92.2	2.2	386.3	7.0	22.7	9.2	105.8	1.4	221.9
1960	87.0	91.8	1.7	305.5	7.0	23.8	10.5	104.6	1.8	227.3

Table 46. (Continued)

	C_P	NI	T_E	TB	T_M	M_C	X_O	GNP	X_T	G_{T-1}
1961	93.4	102.2	2.5	477.5	6.0	21.6	12.0	114.6	2.7	278.1
1962	96.7	106.8	2.6	485.9	7.1	24.3	11.5	120.0	3.4	343.9
1963	103.7	112.4	2.4	489.8	7.8	27.8	12.2	127.4	4.3	440.2

	t	Y_S	$Y-Y_S$	D
1958	1	21.8	78.5	5.1
1959	2	22.0	83.0	4.6
1960	3	22.5	78.7	4.5
1961	4	24.6	85.5	5.2
1962	5	26.4	88.9	5.1
1963	6	28.2	95.1	6.0

Table 47. Data 1956 - 1964

	T_E	T_B	FL_{-1}
1956	1.8	370.6	2.44
1957	1.6	331.1	3.73
1958	2.2	423.9	4.28
1959	2.2	386.3	4.09
1960	1.7	305.5	3.76
1961	2.5	477.5	4.06
1962	2.6	485.9	3.86
1963	2.4	489.8	3.48
1964	2.5	499.0	3.87

Table 48. Data 1952 - 1964

	Y_T	LT_{-1}	M_{VH}	Y_{-1}
1952	6.9	3.76	1.66	76.6
1953	7.7	4.32	1.97	85.4
1954	8.9	5.15	2.32	91.6
1955	9.2	5.95	3.44	92.2
1956	9.7	7.15	3.44	96.3
1957	10.5	8.06	4.40	105.3
1958	9.8	8.04	2.90	112.7
1959	10.6	8.32	3.78	100.3
1960	10.4	7.52	3.65	105.0
1961	11.5	7.04	3.92	101.2
1962	12.1	11.48	4.59	110.1
1963	13.0	12.37	3.02	115.3
1964	11.7	14.21	1.67	123.3

Table 49. Data 1951 - 1960

	T_{D-58}	NI_{NA}	NI
1951	2.9	54.8	68.3
1952	3.9	59.7	76.0
1953	4.5	61.2	82.3
1954	3.6	62.0	81.1
1955	3.9	64.7	82.9
1956	5.0	68.9	88.6
1957	5.8	77.6	97.9
1958	4.4	72.6	90.5
1959	3.5	72.5	92.2
1960	4.2	73.6	91.8

Table 50. Data 1950 - 1958

	T_D	N_I	Y_{MN}	$Y-Y_{MN}$
1950	1.9	69.4	5.7	59.4
1951	2.9	68.3	6.0	66.8
1952	3.9	76.0	6.8	75.5
1953	4.5	82.3	5.4	81.0
1954	3.6	81.1	6.2	81.3
1955	3.9	82.9	5.7	85.0
1956	5.0	88.6	7.1	93.3
1957	5.8	97.9	7.5	101.1
1958	4.4	90.5	7.6	88.1

Table 51. Data 1950 - 1960

	T_D	N_I
1950	1.9	69.4
1951	2.9	68.3
1952	3.9	76.0
1953	4.5	82.3
1954	3.6	81.1
1955	3.9	82.9
1956	5.0	88.6
1957	5.8	97.9
1958	4.4	90.5
1959	3.5	92.2
1960	4.2	91.8

APPENDIX D

Selected Alternative Equations

The need for expounding the line of thought leading to the finally accepted result has already been emphasized by Theil. Alternative maintained hypotheses contribute to a better appraisal of the equations which are included in the models.

A number of estimated alternative equations are presented in the following tables.

Table 52. Selected consumption equations

		DF	R^2	F	D-W
1.	$C_P = -1.162 + 0.942\ (NI - .582\ T_D)$	12 (51-64)	.89	98.90	1.83
	t -0.138 9.945				
2.	$C_P = -0.726 + 0.926\ (NI - .582\ T_D + S_{pg})$	7 (56-64)	.70	16.07	1.40
	t -0.032 4.009				
3.	$C_P = -1.619 + .988\ (NI - T_D)$	11	.87	71.77	
	t -0.160 8.47				
4.	$C_P = -2.455 + 0.932\ NI$	11	.90	101.60	1.83
	t -0.292 10.080				
5.	$C_P = 2.270 + 0.782\ GNP$	11	.89	85.37	1.76
	t 0.262 9.240				
6.	$C_P = -20..733 + 1.108\ NI$	4 (58-63)	.89	30.98	1.44
	t -1.045 5.566				

Table 52. (Continued)

		DF	R^2	F	D-W
7.	$C_P = -2.919 + 0.940\ NI$	15 (51-67)	.92	181.53	
	t -0.444 13.473				
8.	$C_P = 61.931 + 2.874\ t$	12 (50-63)	.81	52.79	1.35
	t 20.469 7.266				
9.	$C_P = -3.278 + 0.969\ DI_{(NI-.582\ T_D)}$	11	.90	97.94	1.81
	t -0.379 9.896				
10.	$C_P = -2.806 + 0.984\ (NI-T_D)$	11	.89	93.58	1.83
	t -0.319 9.674				
11.	$C_P = -3.647 + 0.961\ (NI-.582\ T_D + S_{pg})$	7 (56-63)	.72	15.62	1.33
	t -0.156 3.952				

Table 53. Agricultural production equations

		DF	R^2	F	D-S
1.	$Y_A = 5.836 + 0.120\ RA + 0.346\ RF_{-1}$	10	.71	12.22	1.91
	t 1.657 4.874 2.361				
2.	$Y_A = 6.500 + 0.121\ RA + 0.311\ RF_{-1}$	14	.73	19.03	0.39
	t 2.291 6.036 2.581				
3.	$Y_A = 6.340 + 0.117\ RA + 0.331\ RF_{-1}$	11 (50-63)	.75	16.33	1.99
	t 2.149 5.539 2.507				

Table 53. (Continued)

		DF	R^2	F	D-S
4.	$\text{Log}_{10}Y_A = 0.164 + .370\ \text{Log}_{10}RA + .377\ \text{Log}_{10}RF_{-1}$	10	.71	12.13	1.92
	t .634 4.805 2.660				
5.	$Y_A = 5.609 + .107\ RA + .325\ RF_{-1} + .016\ P_{Food\ -1}$	10 (50-63)	.75	9.95	2.00
	t 1.208 2.080 2.302 0.211				
6.	$Y_A = .003 + .137\ RA + .374\ RF_{-1} + .230\ RF$	9	.77	9.782	1.93
	t .001 5.248 2.666 1.460				
7.	$Y_A = 9.366 + .113\ RA + .173\ RF$	10	.58	6.90	1.35
	t 1.920 3.632 .873				
8.	$Y_A = 6.971 + .090\ RA + .320\ RF_{-1} + .177\ t$	9	.75	7.508	2.04
	t 1.483 1.098 1.910 0.389				

Table 54. Selected investment equations

		DF	R^2	F	D-W
1.	$I = 5.690 + .849\ I_{-1} - .509\ GE$	10	.59	7.16	2.63
	t 1.500 3.670 -1.382				
2.	$I = 14.558 + .676\ t$	11	.18	2.49	0.77
	t 4.283 1.579				

Table 54. (Continued)

		DF	R^2	F	D-W
3.	$I = 3.498 + .876\ M_I$	11	.57	14.85	0.56
	t .821 3.854				
4.	$I = 4.356 + 4.286\ GI_{-58}$	11	.57	14.58	0.89
	t 1.068 3.820				
5.	$I = 5.877 + .728\ I_{-1}$	12 (50-63)	.58	16.41	1.75
	t 1.753 4.051				

Table 55. Selected import with domestic substitutes equations

		DF	R^2	F	D-W
1.	$M_{DS} = -7.798 - .405\ Y_A + .218\ Y$	10	.80	19.59	1.28
	t -3.325 -2.156 4.850				
2.	$M_{DS} = -6.557 - .381\ Y_A + .201\ Y$	14 (51-67)	.73	18.71	-
	t -2.987 -2.177 4.619				
3.	$M_{DS} = -5.308 - .527\ Y_A - .958\ Y_{M-1} + .332$ GNP	10 (50-63)	.75	10.26	2.33
	t -2.182 -1.924 -1.633 3.296				
4.	$M_{DS} = -8.637 - .601\ Y_A + .287\ Y$	11 (50-63)	.82	24.38	1.85
	t -3.884 -2.674 5.220				

Table 56. Selected investment and raw material imports equations

		DF	R^2	F	D-W
1.	M_I = -16.217 + .338 GNP	11	.88	78.00	1.38
	t -4.143 8.832				
2.	M_I = -15.784 + .332 GNP	15 (51-67)	.89	120.08	-
	t -4.911 10.958				
3.	M_I = -22.499 + .433 Y	12 (50-63)	.94	195.40	1.94
	t -7.836 13.978				
4.	M_I = 8.968 + 1.277 t	12 (50-63)	.84	63.47	1.21
	t 7.317 7.967				

Table 57. Selected imports of beverages, tobacco and durables equations

		DF	R^2	F	D-W
1.	M_L = -4.650 + .146 NI_{NA}	11	.85	61.92	1.52
	t -3.514 7.869				
2.	M_L = -4.456 + .143 NI_{NA}	15 (51-67)	.82	69.59	-
	t -3.539 8.342				
3.	M_L = -3.322 - .167 Y_A + .149 C_P	11 (50-63)	.81	24.04	1.27
	t -2.398 -1.095 4.061				
4.	M_L = -4.990 - .109 Y_A + .181 NI_{NA}	11 (50-63)	.89	43.43	1.54
	t -4.292 -1.088 5.876				
5.	M_L = 3.101 + .363 t	12 (50-63)	.80	49.43	1.30
	t 7.854 7.030				

Table 58. Selected other imports equations (residual imports mainly fuel and lubricants)

		DF	R^2	F	D-W
1.	M_O = -.350 + .181 VH	11	.91	117.05	1.58
	t -.552 10.819				
2.	M_O = -14.117 + 0.196 GNP	11	.77	37.42	1.22
	t -4.296 6.117				
3.	M_O = -15.261 + 0.298 NI_{NA}	11	.79	42.37	1.13
	t -4.677 6.509				
4.	M_O = -14.811 + .228 NI	11	.75	33.17	1.23
	t -4.104 5.759				
5.	M_O = 8.002 - .154 NI_{NA} + .290 VH_{-1}	10	.97	160.50	-
	t 2.411 -2.478 7.630				
6.	M_O = -.020 + .199 VH_{-1}	11	.96	236.91	2.03

Table 59. Selected direct income tax equations

		DF	R^2	F	D-W
1.	T_D[a] = -4.926 + .560 Y_{MN} + .051 Y	11 (50-63)	.73	15.03	-
	t -3.110 2.515 3.635				
2.	T_D[a] = -4.171 + .553 Y_{MN} + .058 NI_{NA}	11 (50-63)	.66	10.48	-
	t -2.410 2.139 2.801				
3.	T_D[a] = -3.200 + .086 NI	9 (50-60)	.63	15.19	1.15
	t -1.731 3.898				

[a]Current pounds.

Table 59. (Continued)

		DF	R^2	F	D-W
4.	$T_D^a = -4.841 + .108\ NI$	6 (50-58)	.84	36.08	1.49
	t -3.273 6.007				
5.	$T_D^a = -2.944 + .004\ Y_{MN} + .085\ (Y-Y_{MN})$	6 (50-58)	.92	32.55	1.52
	t -2.703 .0182 6.145				
6.	$T_D^a = -4.837 - .002\ Y_{MN} + .1080\ NI$	6 (50-58)	.84	15.46	1.49
	t -2.873 0.007 4.090				
7.	$T_{D_{-58}} = -.808 + .075\ NI_{NA}$	8 (51-60)	.44	6.51	1.37
	t -.411 2.551				
8.	$T_{D_{-58}} = -1.568 + 0.07\ NI$	8 (51-60)	.52		1.39
	t -.803 2.958				
9.	$T_{D_{-58}} = 1.350 + .283\ Y_{MN} + .007\ Y$	14 (51-67)	.13	1.04	-
	t .702 1.274 0.517				
10.	$T_D = -1.849 + .0713\ NI$	7 (51-59)	.54	8.296	-
	t -.881 2.88				

Table 60. Selected excise tax equations

		DF	R^2	F	D-W
1.	$T_E = -.339 + .136\ FL_{-1} + .009\ TB_{okes}$	5 (56-63)	.94	36.04	1.94
	t -.984 1.746 7.774				
2.	$T_E = .456 + .004\ TB$	4 (58-63)	.92	45.34	2.56
	t 1.677 6.733				

Table 60. (Continued)

		DF	R^2	F	D-W
3.	T_E = .083 + .005 VH + .004 TB	10	.95	91.67	1.38
	t .418 1.508 6.020				
4.	T_E = -.109 + .005 TB	11 (58-63)	.94	162.26	1.01
	t -.674 12.738				
5.	T_E[a] = -.136 + .020 $\overline{VH}$ + .003 TB	11 (50-63)	.96	137.63	1.10
	t -.590 5.056 3.636				
6.	T_E = -.285 + .005 TB + .135 FL_{-1}	6 (56-64)	.94	45.55	1.83
	t -.910 8.705 1.846				
7.	T_E = -.120 + .005 TB + .034 FL_{-58}	10	.94	80.30	1.19
	t 0.734 10.02 .912				
8.	T_E = -.070 + .005 TB + .078 FL_{-1}	10	.96	120.36	1.54
	t -0.5.5 10.140 2.433				
9.	$T_{E_{-58}}$ = .116 + .005 VH + .004 TB_{okes}	14 (51-67)	.95	139.79	-
	t .773 1.838 7.878				

[a]Current pounds.

Table 61. Selected taxes on imports equations

		DF	R^2	F	D-W
1.	T_M = 1.770 + .216 M_C	11	.89	85.51	3.37
	t 3.993 9.247				

Table 61. (Continued)

	DF	R^2	F	D-W
2. T_M = -.736 + .318 M_C	4 (58-63)	.87	27.32	2.21
t -.516 5.226				

Table 62. Selected other taxes (residual) equations

	DF	R^2	F	D-W
1. T_O = -10.107 + .174 NI	12 (50-63)	.51	12.47	0.58
t -2.284 3.532				
2. T_O = 1.396 + .610 t	12 (50-63)	.63	20.21	0.56
t 1.345 4.495				

Table 63. Selected licensed vehicles equations

	DF	R^2	F	D-W
1. VH = -19.888 + 3.065 M_I	15 (51-67)	.82	70.21	-
t -2.749 8.379				
2. VH = -15.759 + 2.776 M_I	12 (50-63)	.82	56.03	0.73
t -2.340 7.485				

Table 64. Selected agricultural exports equations

		DF	R^2	F	D-W
1.	$X_A = 3.383 + .210\ Y_A$	11	.26	3.767	1.20
	t 1.575 1.941				
2.	$X_A = 3.924 + .166\ Y_A + .045\ t$	10	.26	1.78	1.14
	t 1.391 .936 .316				
3.	$X_A = 2.404 + .262\ Y_A$	15	.34	7.668	-
	t 1.235 2.770				
4.	$X_A = 4.635 + .096\ Y_A + .128\ t$	14 (51-67)	.40	4.688	-
	t 1.744 .579 1.212				
5.	$X_A = 2.531 + .118\ Y_A + .063\ C_P - .028\ P_{Food\ -1}$	10 (50-63)	.40	2.20	1.47
	t 1.181 0.507 0.946 -7.33				
6.	$X_A = .672 + .117\ Y_A + .023\ C_P + .473\ UK_{F-1}$	10 (50-63)	.37	1.96	1.30
	t 0.109 0.494 0.411 0.271				
7.	$X_A = 5.353 + .233\ Y_A - .025\ \frac{P_{XA}}{P_{Food}}$	11 (50-63)	.37	3.168	1.24
	t 1.148 2.226 -0.666				
8.	$X_A = 1.661 + .171 + .019\ P_{XA-1}$	11 (50-63)	.37	3.245	1.20
	t 0.713 1.176 0.738				
9.	$X_A = 2.708 + .279\ Y_A - .008\ P_{Food\ -1}$	11 (50-63)	.34	2.885	1.55
	t 1.275 1.783 -0.263				
10.	$X_A = 1.677 + .141\ Y_{A-1} + .024\ P_{XA-1}$	11	.34	2.87	0.87
	t 0.697 0.926 0.954				

Table 64. (Continued)

		DF	R^2	F	D-W
11.	$X_A = -.920 + .130\ Y_{A-1} + 1.093\ UK_{F-1}$	11 (50-63)	.33	2.68	1.16
	t -0.177 0.723 0.792				
12.	$X_A = -7.090 - .044\ P_{Food-1} + 3.430\ UK_{F-1}$	11 (50-63)	.34	2.88	1.26
	t -1.062 -0.896 1.779				
13.	$X_A = -2.683 + 1.875\ UK_{F-1}$	12 (50-63)	.30	5.03	1.11
	t -0.598 2.243				
14.	$X_A = 2.708 + .279\ Y_A - .008\ P_{Food-1}$	11 (50-63)	.34	2.885	1.55
	t 1.275 1.783 -0.263				

Table 65. Selected mining exports equations

		DF	R^2	F	D-W
1.	$X_{MN} = 1.881 + 1.108\ Y_{MN}$	11	.76	35.33	1.21
	t 1.496 5.944				
2.	$X_{MN} = 2.182 + 1.201\ Y_{MN} - .005\ P_{MN-1}$	11 (50.63)	.81	23.09	1.68
	t 1.744 6.724 -1.079				

Table 66. Selected other exports (residual) equations

		DF	R^2	F	D-W
1.	$X_O = -24.812 + .303\ GNP$	$15_{(51-67)}$	74	43.31	-

Table 66. (Continued)

			DF	R^2	F	D-W
	t	-5.092 6.581				
2.	X_0 =	-25.576 + .349 NI	15 (51-67)	.72	38.64	-
	t	-4.845 6.216				
3.	X_0 =	-26.803 + .463 NI_{NA}	15 (51-67)	.77	50.00	-
	t	-5.566 7.071				
4.	X_0 =	-2.957 + .122 GNP	4 (58-63)	.75	11.84	1.46
	t	-0.741 3.440				

Table 67. Selected tourism equations (travel contribution to balance of payments account)

			DF	R^2	F	D-W
1.	X_T =	-2.538 + .045 $\overline{TV}$ + .740 $\overline{HB}$	14 (51-67)	.96	179.89	-
	t	-2.495 6.750 2.636				
2.	X_T =	-.592 + .005 G_{T-1} + .453 t	3 (58-63)	1.00	610.66	2.60
	t	-3.477 3.649 6.489				
3.	X_T =	-.040 + .697 t	4 (58-63)	.99	296.20	1.57
	t	-.254 17.210				

Table 68. Selected value added equations (manufacturing including electricity and gas)

			DF	R^2	F	D-W
1.	Y_M =	6.852 + .494 LTM_{-1} + .651 M_{IR-58}	5	.97	70.45	1.47
	t	8.171 4.476 3.519				
2.	Y_M =	7.558 + .415 GI_{-58} + .175 LB_{-1}	10	.97	163.52	2.53
	t	18.296 2.693 11.286				
3.	Y_M =	8.688 + .558 t	11	.94	180.82	0.83
	t	26.394 13.447				
4.	Y_M =	8.202 + .059 EC - .878 K_M + .573 GI + .260 M_I	9	.99	172.73	1.64
	t	20.604 6.853 -5.652 3.317 3.451				

Table 69. Selected value added equations (services including banking insurance and real estate)

			DF	R^2	F	D-W
1.	Y_S =	-9.123 + .393 $Y-Y_S$	4 (58-63)	.91	40.72	2.66
	t	-1.740 6.381				
2.	Y_S =	22.158 + .268 $LWR_{current}$	6 (56-63)	.14	0.96	1.15
	t	7.704 0.981				
3.	Y_S =	9.391 + .144 Y	11	.63	19.08	1.17
	t	2.788 4.368				
4.	Y_S =	19.749 + .497 t	12 (50-63)	.67	24.21	0.77
	t	25.565 4.920				

Table 70. Selected value added equations (transportation, storage and communications)

		DF	R^2	F	D-W
1.	$Y_T = -.474 + .365\ L_T + .074\ Y_{-1}$	10	.93	65.87	2.16
	t -.282 3.652 3.203				
2.	$Y_T = -.668 + .339\ LT + .079\ Y_{-1}$	14 (51-67)	.94	112.20	-
	t -0.484 4.853 4.314				
3.	$Y_T = -3.215 + .312\ LT + .114\ Y_{-1}$	11 (50-63)	.92	65.47	1.51
	t -1.529 2.378 3.483				
4.	$Y_T = 4.563 + .450\ LT_{-1} + .643\ M_{VH}$	10 (52-64)	.89	41.75	2.55
	t 6.558 7.671 3.474				
5.	$Y_T = -2.192 + .106\ Y_{-1} + .529\ M_{VH}$	10 (52.64)	.83	25.26	1.71
	t -1.232 5.880 2.253				

Table 71. Selected government expenditure (GE) equations

		DF	R^2	F	D-W
1.	$GE = 3.361 - .079\ t$	15	.01	.214	-
	t 1.930 -.463				
2.	$GE = .630 + .019\ Y$	15	.01	.080	-
	t .090 .291				

APPENDIX E

Communal Data

This appendix gives the statistical and other data on which the Greek and Turkish contributions to gross domestic product were estimated in Chapter VIII.

Table 72. Ethnic data

	Number	Percentage
Public service		
Government officers (including ministers and members of House of Representatives) as of December 31, 1963		
Greeks:	4,041	75.2
Turks:	1,331	24.8
Security forces (police, gendarmeries and army)		
Greeks:	1,499	63.8
Turks:	851	36.2
Transportation		
Omnibus		
Greeks:	1,945	87.5
Turks:	282	12.6
Taxi		
Greeks:	1,301	87.0
Turks:	196	13.1

Table 72. (Continued)

	Number	Percentage
Lorry		
Greeks:	4,109	86.6
Turks:	535	11.5
Totals, transportation		
Greeks:	7,355	88
Turks:	1,013	12
Value added in agriculture		
Land holdings (donums)		
Greeks:	2,502,441	78.3
Turks:	652,486	20.4
Gross value added, main agricultural crops (1963)		
Greeks:	₺ 16,229,991	87.43
Turks:	₺ 2,333,215	12.57
Land ownership by area (1957)		
Greeks:		80.6
Turks:		16.6
Others:		2.8
Assessed value of privately owned immovable property (1954)		
Greeks:		86.5
Turks:		13.1
Others:		0.4

Table 72. (Continued)

	Number	Percentage
Value added in manufacturing (1962)		
Number of establishments engaging 5 persons and over (A)		
Greeks:		88.9
Turks:		10.8
Number of establishments engaging 1-4 persons (B)		
Greeks:		89.9
Turks:		10.1
Persons engaged in (A)		
Greeks:		91.4
Turks:		6.3
Persons engaged in (B)		
Greeks:		88.7
Turks:		11.3
Gross output in manufacturing[a] In (A)		
Greeks:	20,190,730	92.9
Turks:	913,397	4.2
In (B)		
Greeks:	6,859,243	88.7
Turks:	873,838	11.3

[a]The balance in the above figures is produced by others (Armenians, etc.).

Table 72. (Continued)

	Number	Percentage
Gross output of all establishments		
Greeks:	27,049,973	91.8
Turks:	1,787,235	6.1
Others:		2.1
Mining		
Gross output of all establishments		
Greeks:	2,116,262	24.1
Turks:	104,171	1.2
Others:	6,565,923	74.7
Ethnic consumption		
Gross livestock income by ethnic group		
Greek:	6,800,820	85.4
Turk:	1,167,680	14.6
Registration of motor vehicles (1963) Greeks and Turks only		
Greeks:		85.2
Turks:		14.8
Radio sets		
Greeks:		80.8
Turks:		19.2

Table 72. (Continued)

	Number	Percentage
Television		
Greeks:		79.7
Turks:		20.3
Home consumption of vine products (okes) (extract from vine products schene) 1962		
Greeks:	13,661,000	81.1
Turks:	3,205,000	18.9
Telephones, direct lines (1963)		
Greeks:		89.6
Turks:		10.4
Taxation		
Income tax 1958 (under British)		
Greeks & Greek companies:	1,320,167	29.7
Turks & Turkish companies:	82,257	1.8
Armenians & Armenian companies:	46,532	1.0
Other communities and their companies:	3,002,852	67.5
Total direct taxes, Greeks and Turks only (British) 1958		
Greeks:		92.4
Turks:		7.6

Table 72. (Continued)

	Number	Percentage
Population distribution[a]		
Urban, 1960 census		
Greeks:	141,566	33.6
Turks:	41,970	40.2
Others:	22,447	82.9
Rural, 1960 census		
Greeks:	280,572	66.4
Turks:	62,350	59.8
Others:	4,661	17.1

[a]These figures represent urban or rural population to total population of each ethnic group.